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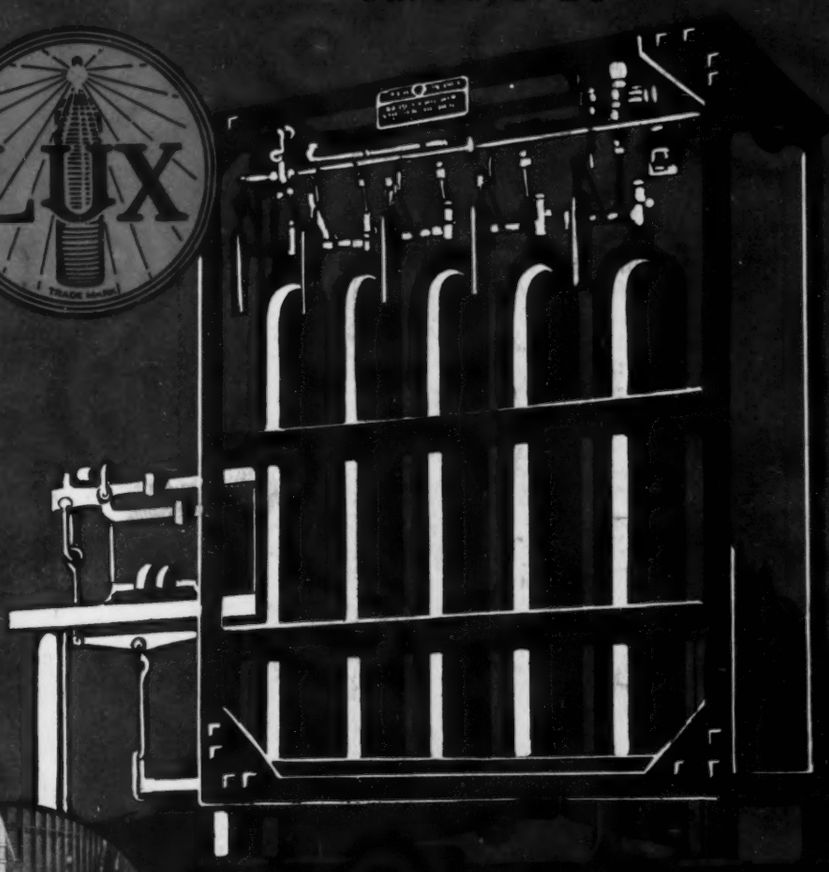

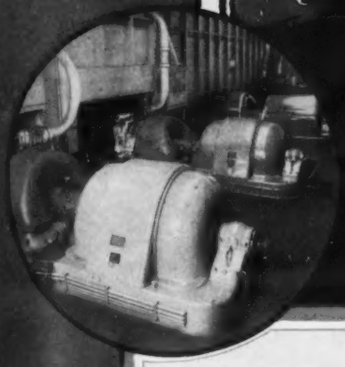

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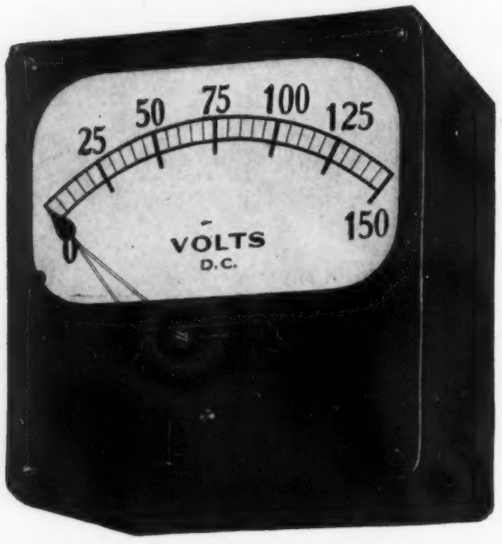


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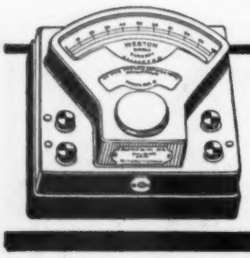

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# Electrical World

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W. H. ONKEN, JR.
*Editor*

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## Sales Managers for Small Syndicates

VIGOROUS and competent leadership is vital to the success of the new commercial movement in electric utilities. Small companies and small groups of companies need inspiration toward greater sales achievement no less than many of their larger brethren. Too often commercial development has lagged far behind normal on such properties because staffs have been busy in other fields. Some syndicates have left matters of commercial policy to local managers to an extent that is now proving unwise, and in typical cases no qualified commercial manager has been a part of headquarters organizations. The time has come to establish real commercial leadership in these syndicates by placing a trained executive in direct charge of such work. Local managers should have no qualms when this is done. The need is for co-ordination of commercial effort, for constructive comparison of results and methods wherever achieved. Rightly planned and carried out, such a program will relieve resident managers of much detail, create new encouragement for their subordinates in sales work, inspire team play in scattered properties, take up lost motion in sales effort and build bigger and better loads. Not a few manufacturers find the lack of a supreme commercial authority in small syndicates a grave handicap in dealing with such organizations, and here indeed is an opportunity which should be seized at the earliest possible moment.

## Isolated Rural Studies Costly and Slow

WHEN a conference on rural electrification as valuable as the one recently held in Chicago is called it is unfortunate that there are not present more of the men who are now facing this problem or who will ultimately be compelled to do so. Regardless of particular beliefs, the fact that twenty state groups are co-operatively studying the subject should be an incentive to every one in the electrical industry who is not yet participating to do so. The results achieved so far can hardly fail to convert pessimists into hopeful and enthusiastic co-operators.

Isolated study or activity will lead to costly experience. Those who feel convinced either that the problem cannot be solved or that they themselves have the correct solution might be greatly surprised if they heard the experiences of others who have given more attention to the subject, and this opportunity is afforded at such conferences as the one in Chicago. Confining attention to the co-operative experiences even of a particular state may result in a costly delay. This is indicated by the fact that some undertakings which have not been in progress long are going over much the same ground as forerunners elsewhere have already traversed. There are plenty of time-consuming original investigations necessary without duplicating studies.

Information regarding what others have done and found on this subject has been made available in part through these pages and more completely through the National Committee on the Relation of Electricity to Agriculture and state project directors. The national committee has always offered and still offers to give advice that will co-ordinate investigations. Quite properly, it does not attempt to dictate procedure. If the individual state or local projects fathered by utility companies are to bring results without retracing the entire trail already marked, the information available to them for the asking or at least by the study of what others have accomplished will be a material assistance. Conferences of the character held in Chicago are invaluable.

## Barriers Reasoned Away

FALSE ideas of the cost of industrial electric heating are disappearing from the minds of factory executives as experience in many installations proves the value of this class of service. Less and less does the utility engineer find himself swept aside by the assertion that electric heating costs too much to warrant its consideration by industrial plant managers. This change in attitude is a real gain. It shortens the labor of analyzing specific cases. It makes an economic determination more certain, and it contributes to the accelerated use of electric heat in standardized processes and experimentally. The over-all cost of the installation is still a hurdle in the path of progress into many plants, but the ability of electric heating engineers to point to an increasing number of successful installations, often in the immediate neighborhood of the prospective customer's establishment, is fast eliminating snap judgments on this subject in the world of industry. The obligation is just as keen as ever for the sales engineers of the utility and of the heating equipment maker to present convincing guarantees, but the prejudgment of heating applications and their cost is now avoided by many manufacturing plant executives formerly inclined to dismiss electricity as economically out of the running without any previous analysis of the field.

## Boston Edison Wins Industrial Lighting Prize

FOR the past year the "industrial lighting activity" has been carried to the four corners of the country by the industrial lighting committee of the National Electric Light Association. Most activities of this character depend for their success upon the efforts of local interests, and this one has been no exception. The members of the committee did their part in stimulating interest and in assisting those communities which were so organized as to make assistance valuable.

The prize of $2,500 has been awarded to the Edison Electric Illuminating Company of Boston. Persons familiar with the commercial activities of central-station companies were not surprised at this announcement.

The Boston company has been doing great work through its lighting division, and much personal credit goes to Julius Daniels for his work, which emphasizes so well what may be accomplished in the sale of better lighting through a systematized department.

The value of a lighting service department is again demonstrated by the report which won the prize for the Boston Edison company. In this connection it is of interest to recall that Mr. Daniels is chairman of the lighting service committee of the Illuminating Engineering Society and of the National Electric Light Association. One of the aims of this committee is to prepare a "Lighting Service Department Manual." This work, which is well under way, should be welcomed by the central stations. It is particularly significant that a man who contributed so much toward the winning of the industrial lighting prize heads this committee. It assures the industry that the methods and organization which have proved successful will be incorporated in the "Lighting Service Manual."

## Now Is the Time to Inaugurate the New Commercial Policy

INTERESTING comments have been made on the report of the special committee on sales organization and management that was presented by S. D. Heed at the recent N.E.L.A. convention. The sales department of the electric light and power industry is admittedly weak. As S. Z. Mitchell said in discussing and indorsing this report, in too many cases sales organization lags far behind engineering and financing, though obviously it should be a balanced function of the business of every utility company.

The weakness of central-station selling lies in the backwardness of the commercial policy of the individual companies. In the security and peace of a protected monopoly they have failed to realize the necessity for the exercise of the same kind of aggressive sales management that is found in competitive business. They have forgotten that they should be striving constantly to meet and overcome the competition that is offered by the steady expansion of the market. For surely the least that any power company should set itself to do is to keep up with and gain upon the growth of its market, which means at the least to sell complete equipment into more homes than are added to the lines each year, to increase the load of their commercial and industrial customers and to better the load factor a bit. Competition with past records and with the records of other companies is no less a pressing obligation upon the executive than the competition that is forced by the activities of a rival in the market. But it has not been generally looked upon in this light.

And this has been so, of course, because company officers are for the most part men who have come up through the engineering, operating or financial branches of the business. Mr. Heed's committee took the courageous course of addressing the executive directly and telling him that there is a principle involved that must be accepted first, before it is time to talk of selling policies and methods. In a word, that principle is that the sales function of an electric public utility must be freed from the domination of engineering expedience and that it must be under the direction of a competent man with a voice in the executive council of the company and adequate authority, organization and financial backing. If the industry will accept this principle, an expanded program of selling may be easily set up with full assurance of success. This will be the big job for the coming year. But the acceptance of this declaration of principle will require more from the executive than a nod of the head. "Yes" will not accomplish anything. There is an issue involved that demands sweeping executive action, and local sales managers must press this issue to decision *now* if anything is to come of it.

## Basic Facts, Not Opinions, Needed for Line Design

THERE has been some rather warm discussion in the past few years in states where utility commissions have undertaken the formation of rules governing overhead-line construction. Pennsylvania and Illinois are two states in which the movement is very much alive at present and attracting a great deal of attention in utility circles. Unfortunately, the whole field of overhead-line construction design and strength has been the subject of serious differences of opinion within the electrical industry almost since its inception. These differences have been sharply emphasized during the past ten or twelve years or ever since National Electrical Safety Code work became active. It is even more unfortunate that in considering the strength of line structures the industry has never been and is not now in possession of the basic facts which determine the effect of climatic conditions in producing stresses in such structures.

The industry itself has been unwilling to face the cost of the research program necessary to find the facts and has attempted to settle the controversy by a compromise of opinions. The result is that the industry is very much in the position of the king and his wise counselors who for months debated the question whether or not a bowl of water weighed more after some fish were placed in it. Some one finally suggested that weighing the bowl would settle the question. Figuratively speaking, the electrical industry must "weigh its bowl" before it can expect to settle this particular problem. In the meantime utility commissions will go further and accomplish more by organizing joint committees and letting them complete the task of formulating proper construction rules. To attempt to sit as judges or arbitrators in the formulation of such rules only puts a commission in the position of the individual who interferes in a quarrel between man and wife and receives a liberal supply of verbal brickbats from both as pay for his efforts.

## Can Suggestion Systems Be Made Effective?

MANY light and power companies have long recognized that their employees are often able to suggest valuable changes in methods, practices and policies which might be temporarily or permanently overlooked if left to the regular development procedure. Furthermore, they have realized that by recognizing the value of such suggestions through public credit, remuneration or otherwise an inducement may be offered for employees to think about them and submit them. One usual difficulty encountered in this connection is that employees fear the reaction of their immediate superiors

to suggestions from below; or the impulse to submit suggestions may lag because of their not being acted upon promptly and considerately or because of failure to give adequate credit for accepted suggestions or to explain the reasons for rejections.

A suggestion system which apparently has none of these objections has been in force in the Commonwealth Edison Company since early in 1925. In a period of ten months 3,416 suggestions were received, of which 604 brought the originators cash or credit awards amounting to slightly over $3,400. The determinable annual cash savings effected through their adoption are estimated to be in excess of $20,000. Among the features of the system that make it successful are these: (1) The identity of the suggestor is never announced until the suggestor discloses it; (2) judging committees, with adequate knowledge and full power, act promptly; (3) awards range from "credits" with a potential value of 50 cents to cash awards with no maximum limit but usually based on 10 per cent of the annual saving (first estimated and later checked); (4) reasons for non-acceptance of suggestions are available to the employees making them.

The results which this or other equally effective suggestion systems will have in giving employees a voice in management, encouraging their special attention to various phases of the company business and bringing about valuable changes in routine or practice are deserving of every company's consideration.

## Relamping Sockets in the Home

THERE are many ways of increasing residence lighting revenue, because even in this progressive country the average home is only "half lighted." Some central-station companies have concentrated upon increasing the wattage of lamps in the various sockets and with good results, and from authoritative surveys of the wiring and lighting equipment in the average wired home it is possible to determine what may be expected in such a relamping campaign.

In living rooms 56 per cent of the ceiling fixtures are of the so-called shower type, averaging 3.5 sockets per fixture, 44 watts per bulb and 154 watts per fixture. If all bulbs of less than 50 watts in all ceiling fixtures are replaced by 50-watt lamps, the increase in lamp load is 33 per cent for the living room. In dining rooms 25 per cent of the ceiling fixtures are of the so-called shower type, averaging 3.1 sockets per fixture, 47 watts per bulb and 146 watts per fixture. By replacing the lamps of smaller wattage in all ceiling fixtures with 50-watt lamps the lamp load may be increased 39 per cent. If this computation be carried out for the ceiling fixtures in the entire home, making the 50-watt lamp the minimum in all cases excepting the kitchen (in which the 100-watt lamp is specified), the lamp load would be increased in about the same proportion. In other words, this is just one of the many ways of increasing lamp load in the home, and there is a possibility by its means of increasing the lamp load by one-third.

Certainly when one studies the matter carefully and considers the illumination requirements for good vision and for the conservation of eyesight, the conclusion is sure that the foregoing recommendations are conservative. But in order to do this job well and permanently these sockets must be equipped with shades. The householder will not easily see the advantage of lamps of greater wattage until the light is properly diffused and the light sources well shaded. It is easy to add shades to shower fixtures and quite possible to modernize many other ceiling fixtures by means of shades or inclosing glassware. One-third of all the ceiling fixtures in the home are obsolete. These may be replaced by approved fixtures which will make lamps of greater individual and total wattage accepted.

## Practical Electric Heat Research in Steel Making

ELECTRIC heating of soaking pits is believed by many electrical engineers to offer distinct advantages to the steel industry through improving the quality and uniformity of steel, savings in loss of metal from scale, better working conditions, economy of space and ultimately lowering the per-ton production cost. Tests made on a comparatively small installation tend to bear out these beliefs. Tabulated results have shown that with electrical energy at 1 cent per kilowatt-hour and steel valued at $30 per ton the electrically heated pit made a saving over other fuels of 10 per cent or more, depending upon the temperatures at which the ingots entered the pit. Most of the savings resulted from lessening the amount of scaling, which remained almost constant at three-quarters of 1 per cent for all conditions and temperatures in the electric pit, while with other sources of heat supply losses from scaling averaged 2¾ per cent and were never less than 1¾ per cent. In spite of this favorable showing, no large-scale installation of electric soaking pits has been made. Manufacturers of electrical equipment, the steel industry and the central-station companies all appear apathetic—the general attitude is to "let George do it."

Much conversation and many reams of good paper have been expended in computing the possibilities and lauding the virtues of industrial electric heating. In this one application there is a practical opportunity for some enterprising central-station company to make an investment in applied industrial research that bids fair to bring thousandfold returns. One company, by no means the largest, estimates that at a rate economically practicable for the steel companies electric operation of the soaking pits in its immediate territory would add more than $300,000 annually to its gross revenue.

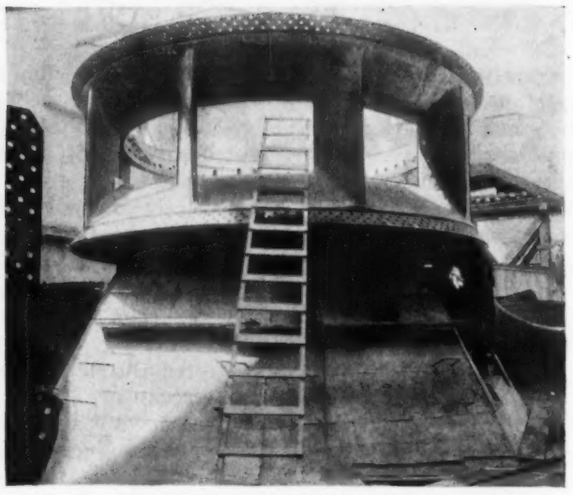
In the territory between Pittsburgh and Cleveland there are now produced more and greater diversity of steel products from the raw materials than in any other section of the country. This same territory is served from the interconnected transmission systems of several large and growing power companies which operate modern and efficient generating stations and are looking for more load. Already these companies have made remarkable progress in supplying the power requirements of the steel industry. But when it comes to the bulk-heating operations such as the electric soaking pit the steel maker naturally wants to be "shown." He wants to know where he can see one in operation and what it will do. Why should not these power companies get together and subsidize the installation of at least one good-sized electrically heated soaking pit in some fairly representative and conspicuous steel mill? It would not make much difference which company's distribution system served the load as they are all interconnected and could easily pool their interests. The object is to get such an installation made under practical operating conditions.

# *First Unit of*
# Cherokee Bluffs Project
## *in Alabama to Be Operating by July*

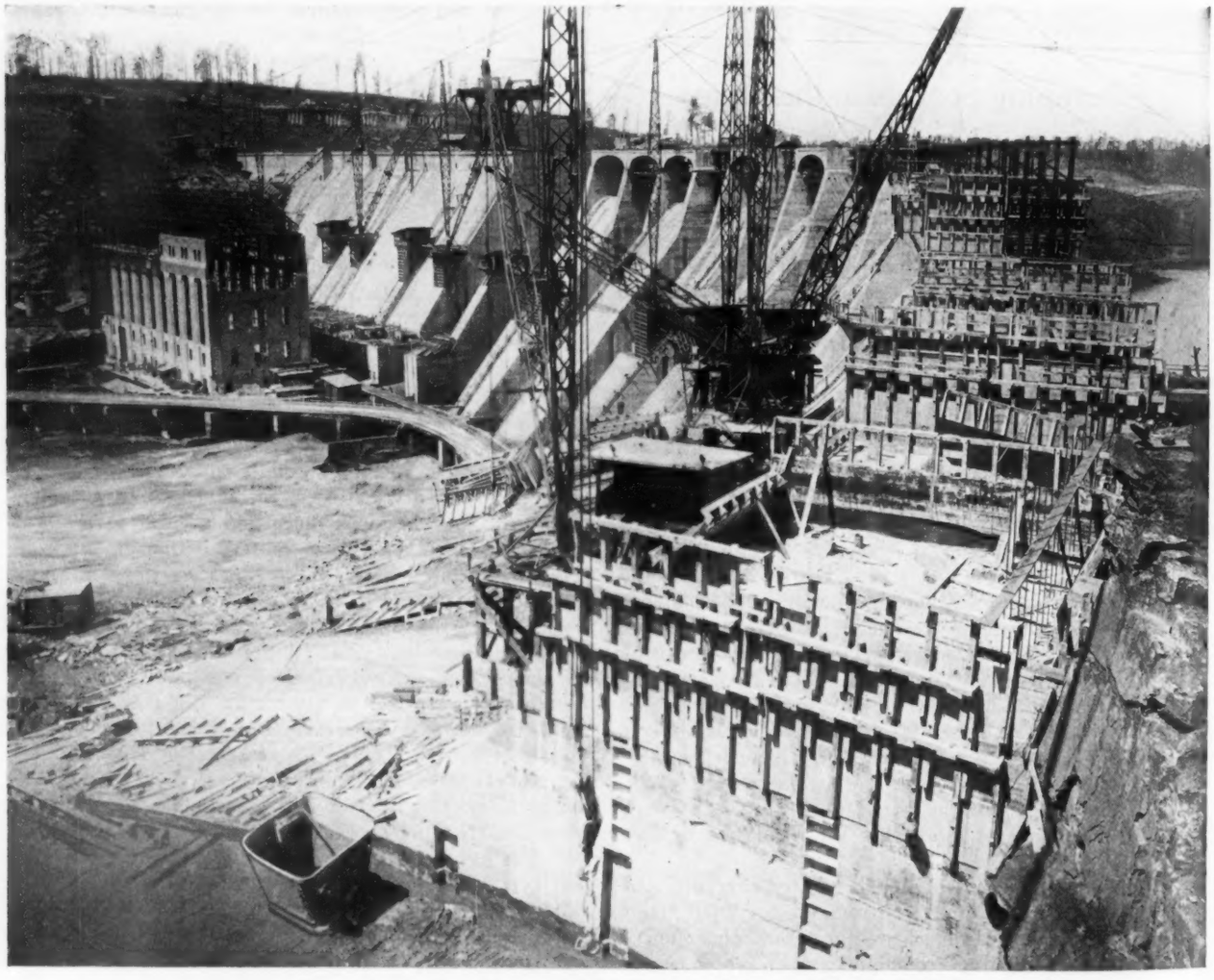
THE hydro-electric development of the Alabama Power Company on the Tallapoosa River known as the Cherokee Bluffs project is going forward rapidly, and it is expected that the first unit will be turning over some time in July. The initial plans call for the installation of three 42,000-hp. or 37,500-kva. units, the second and third units to be placed in service in August and September respectively. The ultimate development calls for a fourth unit, which will require an extension to the present power house.

This development is one of the most interesting projects now under way. Construction was begun in June, 1923. The dam is 150 ft. high and its concrete portion is 1,250 ft. long, this segment being extended another 750 ft. by an earthwork dike. The dam will create the world's largest artificial lake in point of area, the shore line being more than 700 miles. It will cover more than 40,000 acres and will store 530,000,000,000 gal. of water.

The accompanying illustrations give an idea of the size of the project and the progress made up to April 1 of this year.



CONCRETE FOUNDATION AND SPEED RING OF ONE OF THE 42,000-HP. UNITS



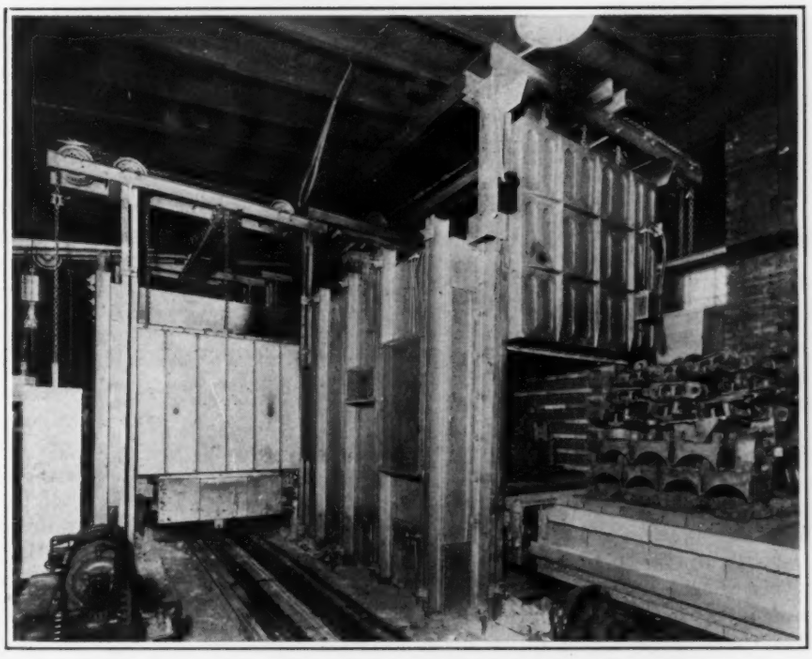
GENERAL VIEW OF CHEROKEE BLUFFS PROJECT FROM THE EAST ABUTMENT

# Electric Heat-Treating of Steel Castings

## Practical Advantages of Electric Furnaces in the Annealing Field—Utilization of Electric Energy as a Source of Heat Compared with Fuel-Fired Furnaces—Methods of Application

By L. E. EVERETT
*Research Engineer Nugent Steel Castings Company, Chicago*

PROVIDED that the temperature of a furnace for heat-treating can be established and maintained within close limits at any desired value, that the temperature can be kept and applied uniformly throughout and that the atmosphere in the furnace does not have a destructive action upon the contents, the quality of the furnace product is not affected by the source of heat. However, these conditions cannot be secured easily with any source of heat but electricity, owing to its inherent adaptability to close control, flexibility of location of heating elements, and possibility of establishing virtually any atmospheric condition. Besides, many refinements of furnace construction and advantages from an operating viewpoint are rendered possible by the use of electricity. In general, whatever can be done with fuel firing can be accomplished with the use of electric heat, and usually more easily and with many benefits.



HEVI-DUTY ELECTRIC COMPANY'S SEMI-RECUPERATIVE FURNACE IN PLANT OF NUGENT STEEL CASTINGS COMPANY

The foregoing and what follows may seem to disparage fuel-fired furnaces, but it is not so intended. Many variously designed fuel-fired furnaces have given excellent satisfaction to their users, particularly in the steel-casting field. However, the many advantages attained by the use of electric energy as the source of heat will stand out more clearly by comparison. The superiority of electric annealing furnaces in the heat-treating of steel castings is well illustrated in the experience of the Nugent Steel Castings Company of Chicago.

### LIMITATIONS OF FUEL-FIRED FURNACE

The prime consideration in the construction of a heat-treating furnace has always been to obtain a uniform temperature throughout the furnace chamber. In fuel-fired furnaces the fact that the greatest temperature always exists at the point of greatest combustion has seriously handicapped designers in reaching or even approximating this goal. Attempts have been made to equalize the distribution of heat in these types of furnaces by means of underfiring, overfiring and indirect firing. In oil and gas furnaces the number of burners has been increased and the locations changed so as to effect better distribution of heat throughout the furnace. Much progress has been made in this respect, and modifications of the above-mentioned variations in furnace design, coupled with different arrangements of flues to recirculate and otherwise distribute the hot air, burned and burning gases, have resulted in very fair efficiency for oil-fired and gas-fired furnaces. In this connection probably the most efficient fuel-fired furnace (using oil, gas, powdered coal or other atomized fuel) is one wherein each exhaust flue is composed of two independent regenerators or "checker" chambers. These are capable of control, so that while the hot exhaust gases from the furnace pass through and heat one set of "checkers" or regenerators, the other set is giving up its heat to the incoming air necessary to support combustion and distribute the heat of the flame. By reversing the draft through the chambers periodically, as is common practice with all regenerative type furnaces, exceptional fuel economy has been realized.

However, irrespective of the efficiency of either fuel or firing practice, any fuel-fired furnace has fundamental characteristics that are, to a certain extent, objectionable or undesirable in an annealing furnace that is to be used for the heat-treatment of small, intricate steel castings of the highest quality.

Because of the intense temperature of combustion of the commonly used fuels, the charge or material to be heated must always be so located, or the flame

so arranged, that the temperature will be reduced or decreased at the point of application to the work to prevent damage from overheating. This means that in a fuel-fired furnace the heating chamber must be considerably larger than required to house the charge. Aside from that fact, a considerable draft is necessary to provide oxygen to support combustion. Whether this is supplied in the atomization of the fuel or otherwise, provision must be made to carry off the burned gases and other products of combustion, which of course

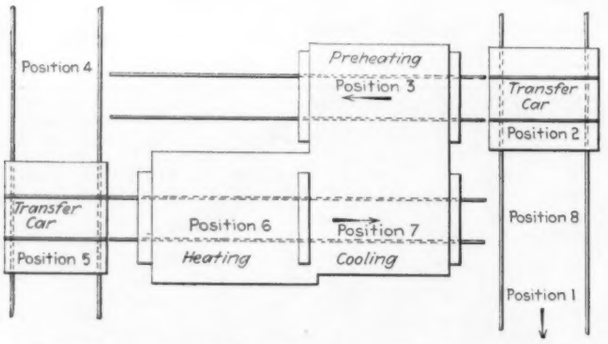



FIG. 1—FLOOR PLAN OF ELECTRIC ANNEALING FURNACE IN THE FOUNDRY OF NUGENT STEEL CASTINGS COMPANY

means considerable reduction in the thermal efficiency of the installation due to the large amount of heat carried by the draft up the stack.

### MAINTENANCE OF FUEL-FIRED FURNACES

Maintenance of fuel-fired furnaces is also an important factor. In the vicinity of the burners and any area of the furnace upon which the flame impinges the life of the usual clay brick refractories is relatively short. If the temperature of complete combustion in a properly controlled "sharp" oil flame is about 3,500 deg. F. and the refractories intimately close to the flame attain temperatures in excess of 2,800 deg. F., or 3,000 deg. F., spalling or otherwise disintegrating effects are greatly aggravated when the brick are allowed to cool to from 800 deg. to 1,200 deg. F., as occurs during the removal and insertion of charges. Coupled with this, the result of the "complete Saturday-to-Monday shut-down practice" has a very severe effect on the life of the refractories. This means that the maintenance of a fuel-fired furnace is bound to be one of the prime cost factors of its operation.

Not only in maintenance but also in operation is the fuel-fired furnace inclined to be expensive. Constant supervision is required to insure proper heat effect. Due to fluctuations in heat intensity, caused by variations in fuels, air pressure and other factors, optimum results from the standpoint of thermal efficiency are the exception rather than the rule.

### ELECTRIC HEAT PERMITS EFFICIENT FURNACE DESIGN

The electric furnace is relatively new in the steel-casting annealing field, and so far the design is based entirely upon what has been known through the employment of the fuel-fired furnace for the same class of work. In the fuel furnace the chamber must be of such size that the circulation of heat can pass around the charge practically unimpeded. This is unnecessary because the heat is generated on only one or two sides of the charge and must be radiated, absorbed and reradiated before the charge can approach temperature equilibrium. In the electric furnace the heat can be developed entirely within the furnace, and the heating elements or resistors can be spread over from one to six sides of the charge with facility. This freedom of location means that more uniform heating is possible in the electric furnace than in the fuel-fired furnaces.

While, as mentioned before, the temperature of an atomized oil flame is about 3,500 deg. F., in heat-treating steel castings a temperature in excess of 1,750 deg. F. is rarely required. Therefore, during the "soaking" period, there must be a drop in temperature or "lag" of approximately 1,750 deg. F. between the source of heat and the charge. In the electric furnace, particularly one with resistor elements in the sides, top and bottom, this "lag" has been determined in several furnaces and with different sized loads to be around 200 deg. F. The fact, then, that a maximum temperature of only about 2,000 deg. F. is required in the electric furnace has a vital influence upon the refractory life and consequently upon the maintenance cost of the installation. The smaller temperature drop required also makes it possible to utilize very small chambers and still get excellent heat distribution.

### SECURING UNIFORM HEAT DISTRIBUTION

It must not be thought that any furnace because it uses electricity as its source of heat is ideal or even a successful furnace. Electric furnaces can have overheated or underheated zones or areas. Uniform temperature distribution depends entirely upon uniform distribution of the source or sources of heat. Heat rays and light rays are subservient to the same laws, can be collected, intensified, reflected, dispersed and radiated with similar facility. Consequently, to secure maximum uniformity of heat distribution in a furnace, the sources of heat must be so located that all sides of the charge are exposed to the heat rays, generated at all points of the chamber sides—ends, top and bottom. Not only is the distribution of heat more uniform as a consequence, but the charge can also be "brought up" to temperature with a low temperature gradient. This means that no part of the charge is overheated.

Another feature, indicated above, which is practi-

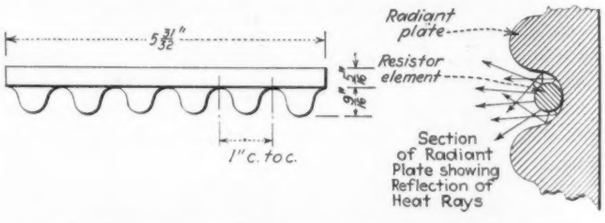



FIG. 2—ROUND ELEMENTS INSTALLED IN RADIANT PLATES EFFECT UNIFORM HEAT RADIATION

cable only when electricity is used as the source of heat, is the use of "bottom heating." Resistor elements can be placed in the car bottom by applying power through "contact shoes" similar to those employed for "third rail" electric transportation systems. The elements in the car bottoms can be protected from abuse, physically and electrically, by cast cover plates of some non-oxidizing alloy.

An important factor in the efficiency of the electric furnace, which is hardly possible of approach when using any other source of heat, is the possibility of completely sealing the firing chamber. This has con-

siderable effect in cutting down direct heat losses through leaks, flues and stacks. Consequently oxidation of the resistor elements and, to some extent, of the charge is considerably retarded with electric heat properly applied.

In a fuel-fired furnace the roof, and walls to a certain extent (depending upon the design of the furnace), must be able to radiate considerable heat to prevent their fusing or melting. In view of the much longer life of electric furnace refractories made possible by the low maximum temperature attained within the heating chamber, more perfect insulation of the wall and roof construction is practicable. This has great effect in increasing the thermal efficiency of the furnace, which is quite essential if electricity is to compete with fuels, as a source of heat energy, at present prices in most districts.

A consideration in electric furnace design is the shape of the cross-section of the resistor elements.

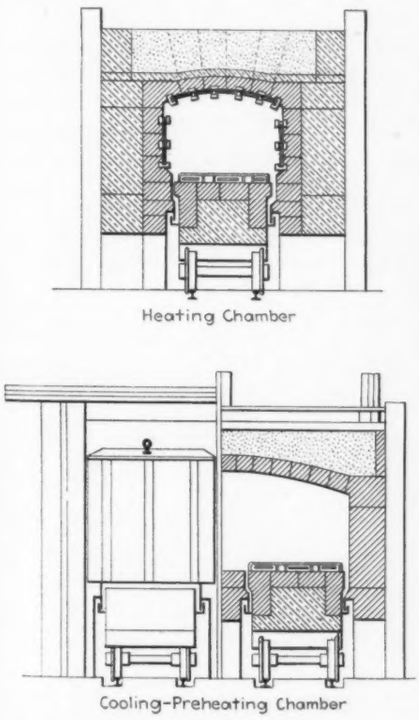



FIG. 3—ARRANGEMENT OF SEMI-RECUPERATIVE ELECTRIC FURNACE

Practically, commercially available heating elements are of two shapes: (1) The flat or ribbon element, and (2) the round element. The flat element of similar cross-sectional area has greater surface or radiating area than the round element, and it is, therefore, subject to more rapid disintegration by oxidation. Aside from that fact, the difficulty of mounting the flat element in a furnace so as to take advantage of its greater radiating surface precludes its common adoption. If mounted with its flat face parallel to the wall, about one-half of its radiating or heating effect is lost, until the furnace wall and the region between the element and the wall are saturated or built up to a higher temperature than the furnace proper or the charge. Then, and not until then, the radiating area becomes effective, as heat transmission is always from the hotter to the cooler body. If mounted with the flat face perpendicular to the wall, adjacent ribbons radiate upon each other and an excess temperature is built up in and between the elements. On the other hand, if round elements are placed in wall corrugations shaped similar to a reflector, the heat will radiate more directly into the furnace.

In order that replacements of heating elements can be made when required, it is highly desirable that they should be arranged in short sections or coils, connected together outside of the furnace. The advantages of this arrangement are apparent in the greater speed and ease of renewal of "burned out" sections, smaller stocks of spares required, and reduced chances for overheating at the joints. Allowance for contraction and expansion of the elements under the varying temperature conditions is necessary. The method of supporting them must be such that they do not sag, bend or warp and thus short circuit one or two coils as a result.

A diagrammatic floor plan of the electric annealing furnace at the Chicago plant of the Nugent Steel Castings Company is shown in Fig. 1, the furnace comprising three chambers; a preheating, a heating and a cooling chamber. The preheating is accomplished through absorption by the cold charge of the heat radiated from the cooling charge, there being no wall between the cooling and preheating compartments. This arrangement makes the furnace semi-recuperative, and although it has no direct bearing on the electrical aspects of the installation, is worthy of note because of the economy in operation effected thereby. This feature permits slow cooling of the heated charge and gradual change of preheating and cooling chamber temperatures without interrupting the continuous operation of the furnace.

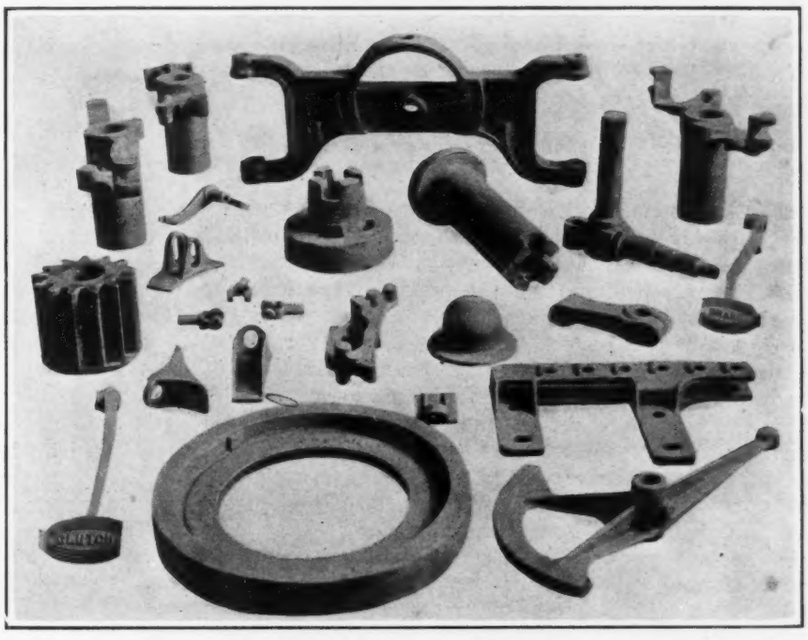


FIG. 4—THE ANNEALING OF THIS TYPE OF ELECTRIC STEEL CASTING IS DONE MOST SATISFACTORILY IN AN ELECTRIC FURNACE

In operating the furnace, four cars are used. Three are at all times within the furnace, and one is outside being unloaded and reloaded. When one heating cycle is completed, a newly loaded car is pushed into the preheating chamber, this operation pushing the formerly preheated charge out onto a track, from which it can be transferred to another running into the heating chamber. Pushing the preheated car into the heat-

ing chamber forces the one therein into the cooling chamber and the cooled load is consequently forced out for unloading and reloading to continue the cycle of operations just described. The movement of the furnace cars, transfer cars and the furnace doors is mechanically accomplished through the employment of electric motors. Limit switches are so interlocked that the various operations can proceed only in proper sequence.

The structural steel work for the entire furnace follows closely that of any fuel-fired furnace. Concrete foundations are employed throughout, the buckstays being set therein. Tie rods, in conjunction with the buckstays, take up the thrust of the roof arch and provide means of compensating for the initial expansion of the furnace. The doors of the heating and cooling chambers are cast-iron frames with regular firebrick lining. Cams or "jamb lugs" are so located that when the doors are lowered they will be held tightly against the furnace and thus prevent loss of heat through leakage at these points. A sand seal along the sides and ends of the cars prevents the excessive loss of heat that would occur if it were not used.

### HEAT INSULATION OF CHAMBERS MORE EFFECTIVE THAN IN OIL-FIRED FURNACES

The heat insulation employed in the heating chamber is decidedly more effective than could be provided for a fuel-fired furnace. It consists essentially of the following, proceeding from the inside of the chamber to the outside: First are the refractory plates, or spacers, for the resistor elements. These "radiant" plates are made of a high refractory combination of magnesium and other elements. The general arrangement of these plates is indicated on the diagrammatic sketch, Fig. 2. Aside from their purpose as refractories, these plates serve the purpose of holding the resistor elements in place, preventing the warping or sagging that would otherwise take place. They also serve as reflectors, being designed with that purpose in mind, and thus prevent the occurrence of excess temperatures between the elements and the furnace walls. As they project between the elements they prevent to a large extent accidental short circuit that might be caused by pieces of the charge falling against them.

Next to the spacers is a layer of 4-in. firebrick tile of about 8x10-in. face. The use of these large tile reduces the number of joints in the furnace. The tongue-and-groove design of the joints of these firebrick tile, coupled with the fact that they are laid with Sil-o-Cel, a high-temperature cement, cuts the heat losses through the joints to a minimum. Behind these tile, furnished by the Seaboard Refractories Company, is a layer of "C-22" Sil-o-Cel brick (Standard 4½x9x2½-in. size) laid on edge.

The materials mentioned constitute the high-temperature insulation of the furnace. Following these, as insulation of the medium temperature, are three layers of natural (green or unburned) Sil-o-Cel brick, likewise laid on edge. For low-temperature insulation, there are three layers of Armstrong's nonpareil high-pressure block in the form of slabs measuring 18x24x2 in. thick. Thus the insulation is so arranged as to permit a gradual tapering off of the heat through the furnace walls. The roof of the heating chamber also contains the refractory plates, tile and C-22 Sil-o-Cel brick, and in addition, about a 12-in. layer of Sil-o-Cel powder.

The heating and cooling chamber insulation consists of one 4½-in. layer of firebrick tile, one layer each of "C-22" and natural Sil-o-Cel brick, laid on edge, followed by two layers of Armstrong nonpareil high-pressure block. The entire furnace is incased in sheet iron, to protect the insulation.

### CAR FLOOR CONSTRUCTION

The furnace cars consist of a built-up structural framework or shell of steel, on which are mounted two courses of natural Sil-o-Cel brick, one course of "C-22" Sil-o-Cel and one course of fireclay brick. This is covered by a layer of specially shaped firebrick tile designed to take the weight of the charge. Refractory plates, similar to those used in the walls and roof, are laid in recesses on top of these tile. Laid on these plates, in the grooves, are the heating elements, the entire assembly being covered with cast, ribbed plates of Misco metal, which protect the elements from injury when the load is placed on the cars. Special "Duralloy" supports are used under the Misco metal plates to distribute the weight of the charge evenly. Electrical contact for the car heating elements is made by contact shoes on the cars which engage with "brushes" in the heating chamber.

The heating elements are composed of flat coils of No. 1 B. & S. gage nickel-chrome rod, composed of approximately 80 per cent nickel and 20 per cent chromium. Round rod is used on account of its heat-resisting efficiency and longer life.

On each wall of the chamber are twelve coils. On the roof arch are eight coils. The heating elements in the car consist of twelve coils. The side-wall and arch coils are about 4 in. long over all and 5¾ in. wide and consist of 50-in. strands of return bends around ¾-in. or 1-in. centers. The car coils consist of sixty-two strands around ½-in. centers.

Temperature is regulated with Leeds & Northrup potentiometer controllers. Two thermocouples are used, one at a point 12 in. below the arch of the furnace and 1 in. above the floor of the cars. These cut in and cut out the entire furnace winding according to the conditions of operation.

### RACKS FACILITATE LOADING AND UNLOADING OF THE FURNACE

On account of the miscellaneous type of work performed by this plant, provision had to be made to care for loading and unloading large, irregularly shaped pieces. Provision was made for this contingency by having car racks of two sizes proportioned so that by turning a rack lengthwise or crosswise of the cars, space is left to pile loose pieces directly on the cars. This practice can be followed without ill effects, due to the metal plates which protect the elements and refractories on the cars from injury.

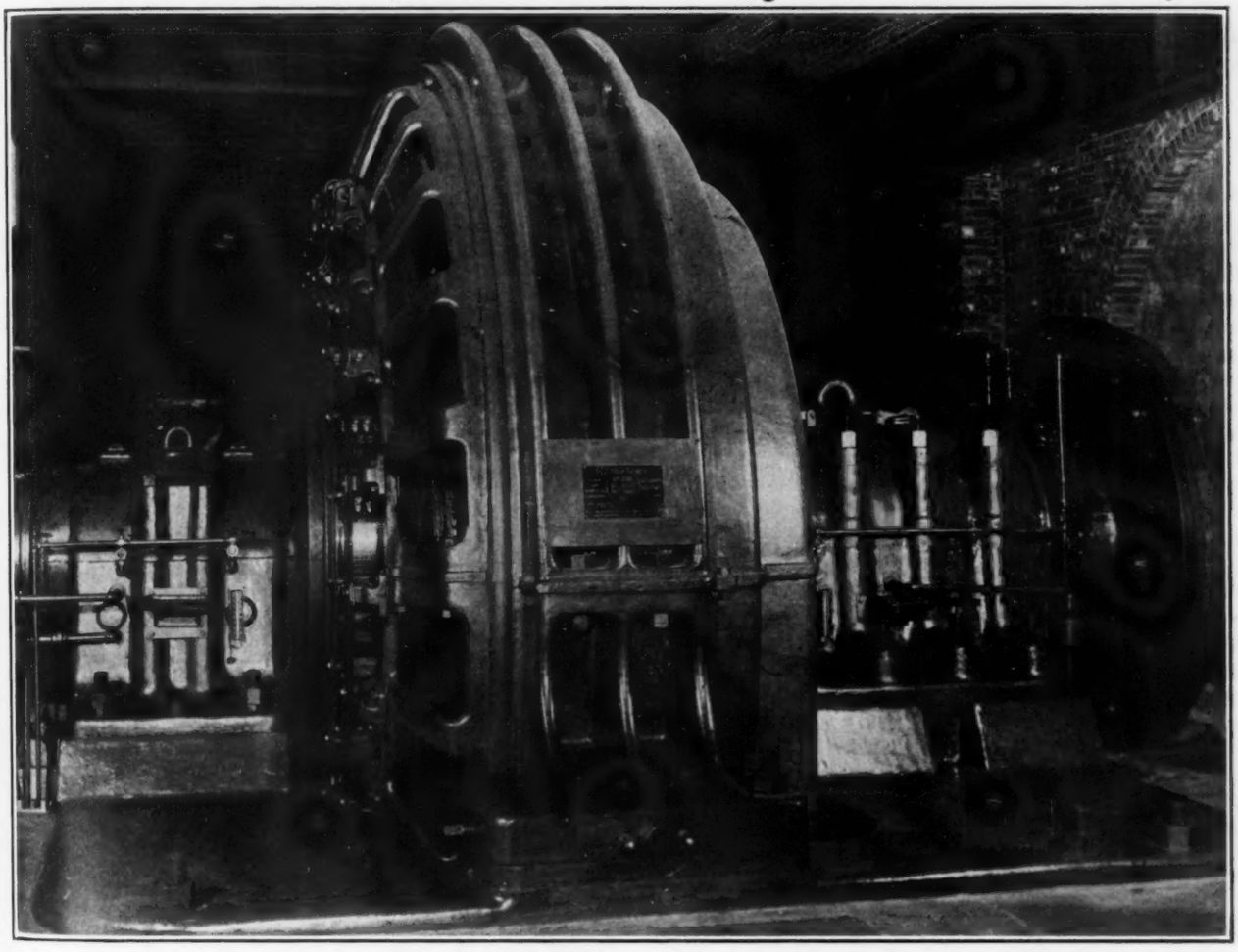
The nominal rating of the furnace is 250 kw. at 220 volts. The furnace is operated at full rated capacity for approximately 75 per cent of the heating period of eighteen hours per day, giving a daily load factor of 56 per cent. It has a capacity of six tons of castings at one charge and when operated continuously has an outupt of 24 tons in twenty-four hours.

The furnace was designed, built and installed by the Hevi-Duty Electric Company.

# Electrification of Indiana Steel Mill

## Kokomo Steel & Wire Company Modernizes Plant by Rebuilding Switching and Distribution System and Installing Reversing Electric Drive on Blooming Mill—Energy Supplied by Northern Indiana Power Company

By A. F. KENYON
*General Engineering Department, Westinghouse Electric & Manufacturing Company*



DIRECT-CURRENT REVERSING MOTOR DRIVING BLOOMING MILL.

THE Kokomo Steel & Wire Company, operating an open-hearth steel plant, blooming and rod-rolling mills and wire-products finishing mills at Kokomo, Ind., has nearly completed an extensive program of improvements that will bring the plant and mills thoroughly up to date, increase production and materially reduce the expenses of operation. Included among the several improvements are the electrification of the 34-in. reversing blooming mill, the revamping and enlargement of the switching and power distribution system and the changing over from mill generation of power to the purchase of power. The revamped switching and power distribution system was placed in service and the power load shifted to the public utility company's lines several months ago. During the month of December the blooming mill was put into operation.

In the manufacture of wire and wire products, the steel ingots are transferred from the soaking pits, where they are evenly heated throughout to a rolling temperature of about 2,300 deg. F., to the main rolls of the reversing blooming mill. By passing the ingot back and forth between the rolls, meanwhile moving the rolls closer together after each pass, the cross-section is reduced to a size that can readily be handled by the finishing mills. At this plant 6,200-lb. ingots of 20x22-in. cross-section are reduced to 4x4-in. billets in the blooming mill. Before being electrified the mill was driven by a direct-connected reversing steam engine, having a maximum operating speed of about 150 r.p.m. in either direction.

The 4x4-in. billets are sheared into 33-in. lengths, carried to the rod mill, reheated, and rolled in the Gar-

rett rod mill to the smallest size it is commercially practicable to produce by rolling, namely, 0.207-in. diameter and known as No. 5 rod. As the cross-section becomes smaller, the steel cools very quickly, and therefore must move through the rod mill very rapidly. To this end the mill is equipped with as many pairs of rolls as the number of passes required, and the rod is looped from one stand to the next so that the steel may be in several roll stands at one time. The rod mill, consisting of eighteen passes, was at one time engine driven, but was electrified several years ago, and is now driven by four wound rotor induction motors of 1,200, 900, 1,300 and 1,500 hp. respectively.

The No. 5 rod is coiled into loose coils as it emerges from the last stand of the rod mill, and after chemical treatment for scale removal, is drawn through a succession of steel dies down to the diameter required by the ingenious automatic finishing machines that form it into woven-wire fencing, barbed wire, nails, staples or any one of dozens of other similar wire products manufactured by the company.

Originally steam engines were used as the direct source of mechanical power for nearly all operations in the plant, such small isolated electric drives as there were being supplied from small engine-driven generators. Eventually, however, the management determined that increased economies in operation would be secured by electrical operation of the mills, and in 1917 the steam engine drive for the rod mill was replaced by the four wound rotor induction motors mentioned above. To supply these motors a steam turbine generating station consisting of two 4,000-kva., 2,300-volt, three-phase, 60-cycle units was erected, and synchronous motor-generator sets were installed to replace the old and inefficient generators for the supply of 250-volt direct-current auxiliary power.

This early installation of electric main roll drive and of generating equipment gave very satisfactory operating results, and the greater economies of electrical operation of the rod mill considerably reduced the costs per ton of steel rolled.

At the time the rod mill was electrified and the turbine generating station erected, the same steam boiler plant that had supplied steam to the various engine drives was retained for the turbine station and such engine drives as were not dismantled. When the decision was made a little more than a year ago to electrify the blooming mill, it was realized that the existing turbine generating station and steam boiler plant were not of sufficient capacity to carry the additional electrical load that would be imposed. As central-station power could be had at a very attractive figure, it was decided to

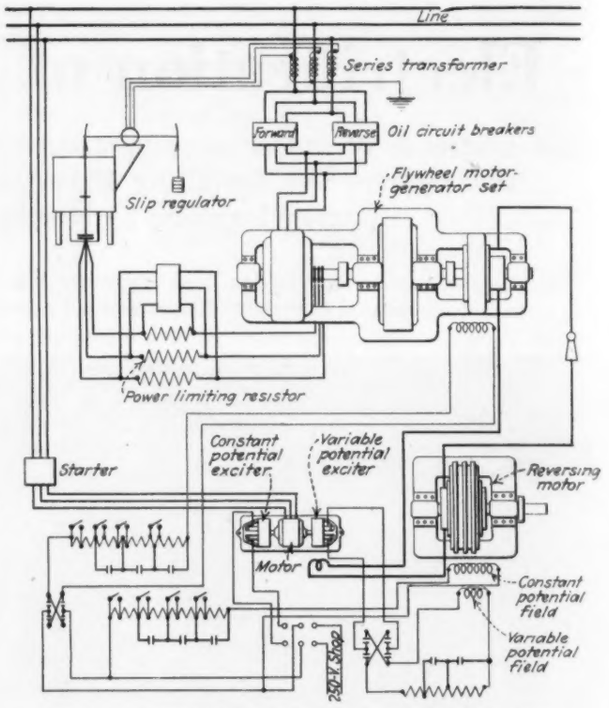



FIG. 1—SINGLE LINE DIAGRAM OF SWITCHING AND DISTRIBUTION SYSTEM

purchase power for the entire electrical load of the mill.

Power is being supplied by the Northern Indiana Power Company. An outdor switching and transformer substation, installed and maintained by the power company on the steel plant premises, supplies 2,300-volt, three-phase, 60-cycle power to the steel plant, the voltage being stepped down from 60,000 volts. At the present time the transformer capacity of the substation is 9,000 kva., but this will be increased if at any time the steel plant load requires it. It is estimated that the maximum demand will be approximately 8,000 kw. and that the annual energy consumption will be about 30,000,000 kw.-hr.

The old switching and power distribution system of the steel plant was installed at a time when the electrical load was comparatively light and was principally located in the same room with the generating equipment. The oil circuit breakers were of only small capacity and no provision had been made for the orderly addition of feeder circuits for the newly electrified mills. In order completely to modernize the switching system and make it adequate to handle the greater concentration of power caused by new electrifications, an

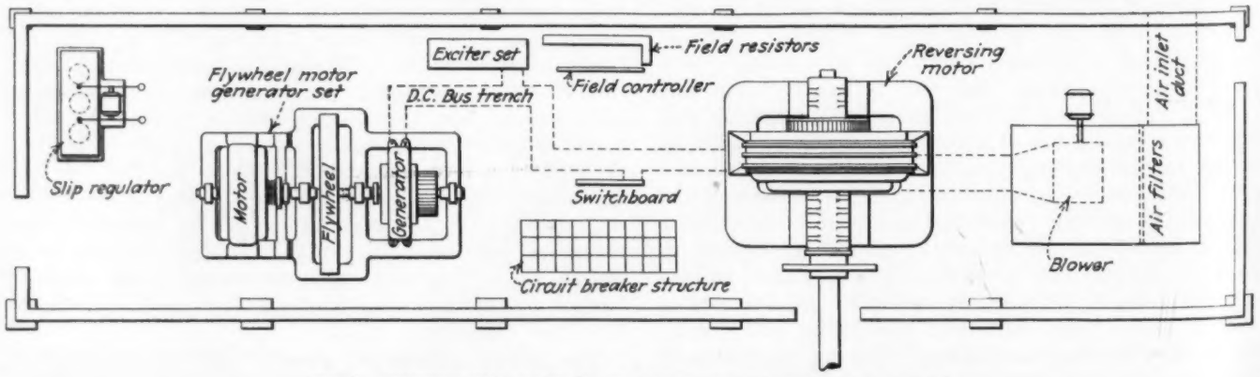
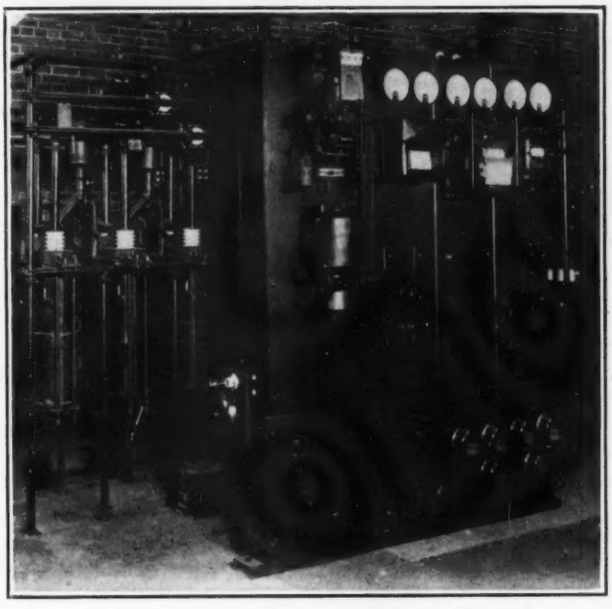



FIG. 2—CONNECTION DIAGRAM OF COMPLETE BLOOMING MILL DRIVE

entirely new circuit breaker structure was erected to take care of present and estimated future needs. All oil circuit breakers, except the main incoming power breaker from the outdoor transformer substation, are Westinghouse type "E-16," direct current solenoid operated, and are mounted in individual compartments of the brick cell structure. The main incoming power breaker is 4,000 amp., type "0-22," and due to its large size, it is mounted in a special reinforced concrete cell near the center of the breaker structure. All of the oil circuit breakers are arranged with 125-volt direct-current closing and shunt trip coils, power for which is supplied by a lead cell storage battery. The battery is kept charged by a small motor-generator set.

Fig. 1 is a one-line schematic diagram showing the main power circuits of the new switching and distribution system, and is of interest because of the adoption of a double bus scheme of connections that permits uninterrupted operation and killing any part of the system for maintenance or inspection with only the increased cost of the second bus and a single tie breaker.



MAIN CONTROL BOARD AND CIRCUIT BREAKERS

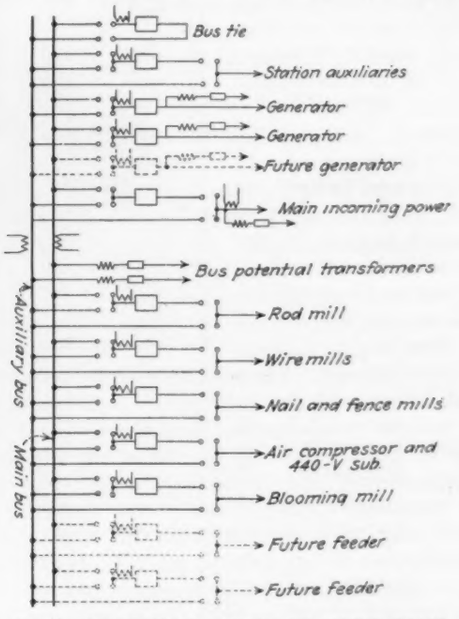



FIG. 3—EQUIPMENT LAYOUT IN MOTOR ROOM

Normally the main incoming power breaker will feed to, and all feeder breakers be fed from, the main bus. Consider now that for any reason it is necessary or desirable to take one of the feeder breakers out of service without interrupting the power supply to that feeder. The particular feeder may be connected to the auxiliary bus and the disconnecting switches closed to the bus tie breaker, after which the bus tie breaker may be closed, paralleling the regular feeder breaker. This feeder breaker and its disconnecting switches may now be opened, and the breaker inspected or repaired in safety. Similarly it is possible to transfer the entire load to the auxiliary bus in order to work on the main bus.

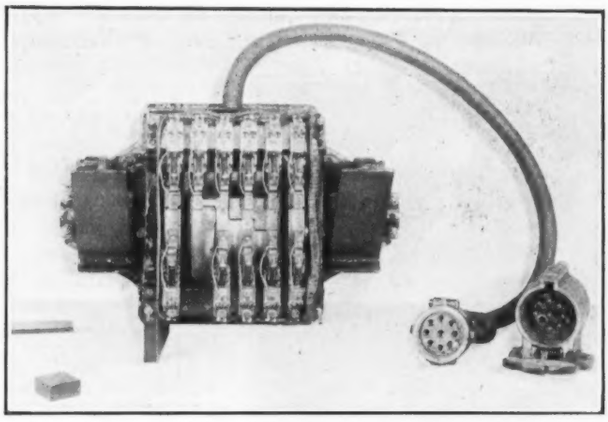
The steam engine driving the 34-in. reversing blooming mill was shut down about the middle of October, 1925. A large supply of billets for the rod mill had been allowed to accumulate, so that there was no great necessity for hurrying the work. The electrical equipment was completely installed and ready for operation on Dec. 14, and the mill was placed in regular operation rolling steel the week of Dec. 20. Thus the work of changing over from steam to electric drive required a little more than two months' time, although if conditions had warranted it, this could have been decreased to a month or less.

The electric drive was furnished complete by the Westinghouse Electric & Manufacturing Company. Fig. 2 is a schematic diagram of the main connections and Fig. 3 shows the layout of the equipment in the motor room. The equipment consists of a direct-current reversing roll motor, supplied with power from a flywheel motor generator set, together with the necessary exciter set, ventilating equipment for the main motor, and switching and control equipment. The reversing motor is of 3,500 hp., continuous capacity, 700 volts, compound wound, compensated, with a full field speed of 50 r.p.m. and a maximum weakened field speed of 120 r.p.m. The motor is capable of exerting a maximum torque of 1,000,000 lb.-ft. at any speed up to the full field speed. This corresponds to 9,500-hp. peak capacity at the full field speed of 50 r.p.m. It has been mentioned that the replaced steam engine had a maximum speed of about 150 r.p.m., and at first thought it might be questioned as to how the same or greater production can be obtained with an electric motor drive the maximum speed of which is only 120 r.p.m. The answer is that, due to the better control of the motor speed and the more rapid acceleration under load, less time is lost in entering the ingot in the rolls, so that the average rolling speed is higher and hence the net rolling time is reduced. Also whereas with the steam engine 31 passes were required to reduce a 20x22-in. ingot to a 4x4-in. billet, with the electric drive the same work is easily being accomplished in 23 passes.

Direct-current power for the operation of the reversing roll motor is supplied by a flywheel motor-generator set consisting of a 3,000-kw., 700-volt, 353-r.p.m., shunt-wound compensated generator, a 60,000-lb. cast steel flywheel 14 ft. 9 in. in diameter, and a 2,500-hp., 353 r.p.m., 2,200-volt, three-phase, 60-cycle, wound rotor induction motor. Excitation for the generator and roll motor fields is normally provided by a small squirrel-cage induction motor-driven exciter set having one gen-

erator unit of 35-kw., 125-volt capacity to supply constant potential for the generator and motor field shunt excitation, and a second smaller generator unit that is separately excited by the main armature current to provide variable potential proportional to the main motor load for the compounding excitation of the reversing roll motor. Provision is made in the switching and control equipment so that in case of accident to the exciter set the generator and motor shunt field excitation may be taken from the 250-volt auxiliary power supply lines. As the fields of the motor and generator are each wound for 125 volts, it is necessary to introduce additional resistance into the field circuits when the 250-volt mill supply is used. This is automatically taken care of by the same multi-polar switches that transfer from the regular to the emergency excitation source.

The primary circuit of the induction driving motor of the flywheel set is controlled by manually operated type E-17 forward and plugging oil circuit breakers mounted in a pipe framework back of the main switchboard. A liquid slip regulator of standard construction is used to limit the starting input and to equalize the peak loads by inserting resistance in the secondary circuit and causing the set to slow down and permit the flywheel to give up some of its stored energy. After the peak has passed, the input to the set is maintained and the flywheel brought back up to speed. Thus by the use of the slip regulator secondary control the input to the set may be kept almost constant, although the power demands of the mill may vary from no load to several times the rating of the induction motor driving the set. Due to the fact that the monthly power bill depends upon the fifteen-minute demand as well as upon the energy consumption, a power-limiting resistor, short circuited by an electrically operated oil switch interlocked with the main forward breaker at all times except when plugging from full speed, is provided to limit the peaks during plugging to below full load.



FOOT-OPERATED MASTER CONTROLLER WITH COVER REMOVED

The operation of the reversing roll motor is controlled from a foot-operated master controller in the pulpit over the mill tables on the entering side of the mill. The operator controls the motor speed and direction of rotation by the operation of the two pedals of the master switch, which in turn energizes the proper control circuits to a magnetic controller in the motor room to vary the direction and strength of the generator and variable potential motor fields and the strength of the main motor field. There are six running speeds in each direction, the first three obtained with full field on the motor by voltage control of the generator, and three above full field speed obtained by field control of the motor with full voltage. Sensitive relays operate in conjunction with the master controller to assist the operator in the best and most effective handling of the machines by automatically functioning to force acceleration and to maintain voltage on the generator after the flywheel set has slowed down under load. The use of foot-operated master controllers for reversing rolling mills is a comparatively new development that has enabled the production of steel at higher rates and lower unit costs. By permitting the roller to control the main rolls with his feet, leaving his hands free for the control of the mill tables and screwdown, the pulpit crew is reduced to two men, saving the wages of the third operator. Also by the concentration of the control to two men rather than to three, closer coordination of operations is secured, resulting in the faster and more efficient manipulation of the mill.

In addition to the foot-operated master controller there is mounted in the pulpit a small hand-operated inching controller to be used when setting up the mill or putting in new rolls or spindles. This controller has three positions each way. The first position energizes the proper control circuits to close a field-neutralizing connection that connects the generator armature across the generator field in such a direction as to kill the residual voltage and prevent creeping of the motor armature. This permits the accurate stopping of the motor at any desired point without opening the main carbon circuit breaker. On the second and third points of the inching controller the field neutralizing connection is opened and the generator field weakly excited to give a speed considerably slower than that obtained on the first point of the foot-operated controller. The circuits of the two master controllers are so interlocked that moving either controller from the off position makes the other inoperative.

The flywheel motor-generator set operates at a comparatively high speed, and the natural circulation of air produced by the rotors of the machines is sufficient to furnish thorough ventilation without any artificial means. The large reversing roll motor, however, rotates at relatively low speeds, and may be carrying as much as 250 per cent of full load current at any speed from standstill to 120 r.p.m. It is therefore necessary to inclose the motor and to provide artificial forced ventilation of 30,000 cu.-ft. of air per minute from a motor-driven blower. This ventilating air is cleaned by passing through a dry filter before going to the blower inlet. The control of the 40-hp. induction motor driving the blower is on the same circuit as the driving motor of the exciter set, thus assuring that the ventilating equipment is in operation and air passing through the motor before the motor can be placed in service.

The outboard bearing of the reversing motor has mounted upon it an overspeed trip that is actuated by a centrifugal speed limit device on the main motor shaft. This trip acts directly on the main carbon circuit breaker and shuts down the motor in case of overspeed from any cause.

In normal operation the blooming mill is operated on a single-turn basis of ten hours per day, and the electrical equipment will, therefore, be in operation only a portion of the time. In order to prevent the accumulation of moisture on the windings by "sweating" during

these daily and week-end shutdowns when the temperature variations may be rapid and large, space heaters are built into the frame of the induction motor, and grid heaters are placed in the pits under the large direct-current machines. The control is so arranged that the heaters cannot be energized during operation of the equipment.

The main direct-current connections between the generator, variable potential exciter field, tie panel and reversing motor are made of bus copper supported on heavy duty pillar type porcelain insulators in a plate-covered trench in the motor room floor. All other main and control connections between the various machines and the switching and control equipment are in fiber and steel conduit laid in the concrete floor.

Although the electrical equipment has not been in operation a sufficient time to secure a great amount of operating data, it is believed that the cost of rolling steel will be reduced by at least $1 per ton. The blooming mill rolls billets only for the rod mill, which has a maximum monthly capacity of about 10,000 tons, and as the blooming mill can easily produce this tonnage by single-turn operation, the annual savings secured by electric drive will not be so great as though the mill were being operated to capacity. Even on the single-turn basis of operation the savings to be effected by electrification will be great enough to pay for the total cost of the improvement in a little more than two years, and after that time the net savings will be more than $100,000 per year.

# Rupturing Circuits with Air Breakers

## Tests Made by Union Gas & Electric Company Show Good Performance at 250 and 500 Volts—Effect of Short Circuits on Breakers—Conclusions Favorable to Ratings—Ultimate Safe Ratings Determined

THE USE of air breakers instead of oil breakers for many low-voltage heavy-duty applications has been advocated by many engineers. Arguments have been made pro and con, and fire hazards, space requirements, maintenance costs and reliability under short-circuit conditions have been major elements considered.

In order to determine the practicability of rupturing large currents with inclosed air breakers, the Union Gas & Electric Company of Cincinnati conducted an elaborate series of tests on air breakers made by the Cutter Company. Five different commercial types of U-Re-Lite breakers were tested under various conditions. These breakers were rated from 15 to 150 amp. at 250 and 500 volts and were subjected to short circuits both single phase and three phase, giving root-mean square current values of 7,500 amp., 11,500 amp. and 22,950 amp. The tests were very favorable to the breakers and determined maximum safe rupturing capacities as given in Table I.

TABLE I—MAXIMUM SAFE RUPTURING CAPACITY OF INCLOSED AIR BREAKERS
(Single-phase operations represent a phase-to-phase short circuit)

| Nominal, Amp. | Rating, Volts | No. of Poles | Permissible Rupturing Capacity Amp. | Phases | Type of Breaker |
|---|---|---|---|---|---|
| 15 | 500 | 3 | 7,500 | 3 | Auto-U-Re-Lite J |
| 150 | 250 | 3 | 11,600 | 3 | Auto-U-Re-Lite Sr. |
| 150 | 500 | 3 | 23,000 | 3 | Auto-U-Re-Lite W |
| 15 | 500 | 3 | 7,300 | 1 | Auto-U-Re-Lite Jr. |
| 30 | 250 | 2 | 9,900 | 1 | U-Re-Lite Jr. |
| 60 | 250 | 2 | 8,500 | 1 | U-Re-Lite Jr. |
| 150 | 250 | 2 | 11,000 | 1 | U-Re-Lite Sr. |

### CONCLUSIONS OF TEST ENGINEER

The breaker performance was remarkably good under the severe duty to which they were subjected, according to J. P. McFarlan, test engineer for the Union Gas & Electric Company. He stated that, in his opinion, the tests showed that the breakers will give good and dependable service for the duties specified in Table I. Favorable features for use of the air breakers as brought out by the tests were:

1. Burned contacts can be removed readily when necessary.

2. Inspection is readily made, as in comparison with oil breakers there is no tank to remove or oil to test.

3. Maintenance is inexpensive and quickly made. The

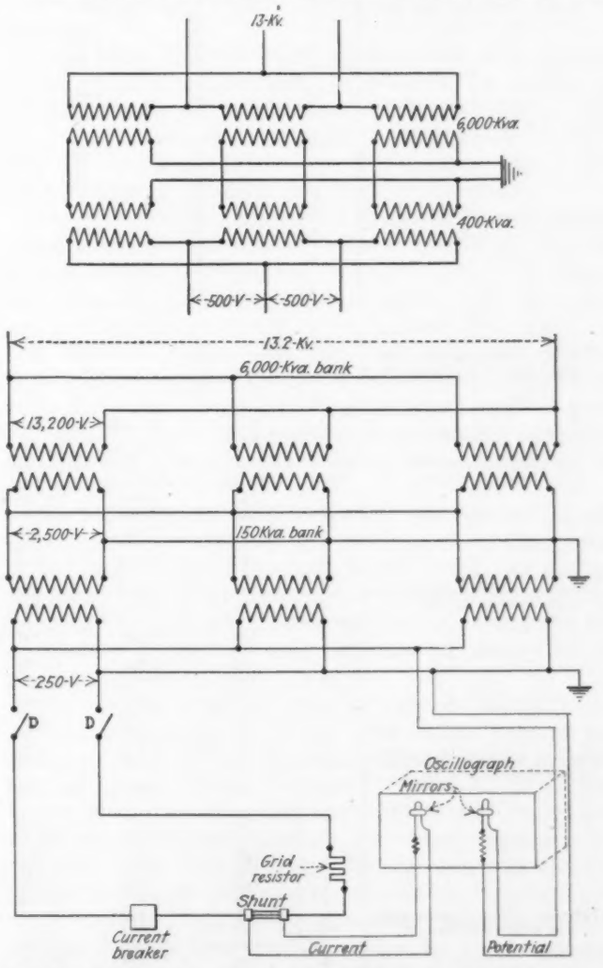



FIG. 1—SOURCE OF SUPPLY FOR INCLOSED AIR BREAKER TESTS
Above—Used for 500-volt, three-phase tests. Below—Used for 250-volt, single-phase tests. The capacity of the low-tension transformers was later increased to 250 kva.

distance between contact points is ample for extinguishing the arc and there is not the trouble or time involved in removing tanks and changing oil that is found with oil breaker maintenance.

### WEAK POINTS DISCOVERED

Although the tests as a whole showed that the breakers were dependable and reliable, they also showed some weak points in the breakers when subjected to severe duty. These were outlined by Mr. McFarlan as follows:

1. Overload coils should be braced between turns. In every test at heavy current, where flat copper was used in the coil, it collapsed.

2. The copper arcing tips should be improved considerably. A number of heavy short circuits causes the copper tips to become soft and they fail to make contact.

The detailed tests and results are given in Table II.

## Table II—Results of Short-Circuit Tests

**(a) 220-Volt, Single-Phase, Short-Circuit Test**

| Rating and Type of Circuit Breaker | No. of Trial | Amp. Setting | Max. Amp. Interrupted | Operation | Time in Seconds to Open Circuit | Remarks |
|---|---|---|---|---|---|---|
| 15-amp, 250-volt Auto U-Re-Lite Jr. | 1 | 15 | 220 | Did not trip | ..... | ..... |
| | 2 | 15 | 220 | O.K. | ..... | ..... |
| | 3 | 15 | 440 | Opened by hand | ..... | Resistance in external circuit failed |
| | 4 | 15 | 680 | O.K. | 0.333 | ..... |
| | 5 | 15 | 1,230 | O.K. | 0.025 | ..... |
| | 6 | 15 | 1,726 | O.K. | 0.0167 | ..... |
| | 7 | 15 | 2,500 | O.K. | 0.0167 | ..... |
| | 8 | 15 | 2,930 | O.K. | 0.0167 | ..... |
| | 9 | 15 | .... | O.K. | ..... | ..... |
| | 10 | 15 | .... | O.K. | ..... | ..... |
| | 11 | 15 | .... | O.K. | ..... | Breaker closed in on short on hot circuit |
| | 12 | 15 | .... | O.K. | ..... | Breaker closed in on short on hot circuit |
| | 13 | 15 | .... | O.K. | ..... | ..... |
| | 14 | 15 | 4,045 | O.K. | 0.0167 | ..... |
| | 15 | 15 | .... | O.K. | ..... | Contacts slightly burned |
| | 16 | 15 | .... | O.K. | ..... | Dead-short |
| | 17 | 15 | .... | O.K. | 0.025 | Trip coils heated badly, main contacts badly burned |
| 30-amp., 250-volt, two-pole type Auto-U-Re-Lite Jr. | 1 | 30 | 729 | O.K. | 0.075 | ..... |
| | 2 | 30 | 1,370 | O.K. | 0.0416 | ..... |
| | 3 | 30 | 2,170 | O.K. | 0.0333 | Contacts slightly burned |
| | 4 | 30 | 3,900 | O.K. | 0.0167 | Contacts slightly burned |
| | 5 | 30 | 4,100 | O.K. | 0.0167 | ..... |
| | 6 | 30 | .... | O.K. | ..... | Contacts slightly burned |
| | 7 | 30 | .... | O.K. | ..... | Contacts slightly burned |
| | 8 | 30 | .... | O.K. | ..... | Contacts slightly burned |
| | 9 | 30 | 9,590 | O.K. | 0.0292 | Dead short |
| | 10 | 30 | 9,880 | O.K. | 0.0167 | Contacts burned |
| | 11 | 30 | 7,880 | O.K. | 0.0083 | One contact welded shut; other contact burned so that it does not make contact; carbon contact closes circuit |
| | 12 | 30 | 9,000 | O.K. | 0.0167 | Main contact badly burned; trip coils badly distorted |
| | 13 | 30 | 17,500 | O.K. | 0.0167 | Main contact burned so badly that carbon contacts only make contact; trip coils badly distorted |
| 60-amp., 250-volt, two-pole type Auto-U-Re-Lite Jr. | 1 | 40 | 220 | O.K. | ..... | ..... |
| | 2 | 40 | 440 | O.K. | ..... | ..... |
| | 3 | 40 | 5,220 | O.K. | 0.025 | Contacts slightly burned |
| | 4 | 40 | .... | O.K. | ..... | Only one side opened |
| | 5 | 40 | .... | O.K. | ..... | ..... |
| | 6 | 40 | 8,510 | O.K. | 0.0167 | ..... |
| | 7 | 40 | .... | O.K. | ..... | ..... |
| | 8 | 40 | .... | O.K. | ..... | One side of breaker welded shut; trip coils badly distorted; secondary contacts practically burned off |
| | 9 | 40 | .... | O.K. | ..... | All contacts badly burned; one side opened; other side welded shut; one carbon contact broken |
| 150-amp., 250-volt., two-pole type Auto-U-Re-Lite Sr. | 1 | 150 | .... | O.K. | ..... | Closed in on short on hot circuit |
| | 2 | 150 | 11,000 | O.K. | 0.025 | Carbon contacts slightly burned |
| | 3 | 150 | .... | .... | ..... | One side welded shut, had to be opened by hand |
| | 4 | 150 | .... | O.K. | ..... | Dead short |
| | 5 | 150 | .... | O.K. | ..... | Dead short |

**(b) 440-Volt, Three-Phase, Short-Circuit Tests**

| Rating and Type of Circuit Breaker | No. of Trial | Amp. Setting | A Phase Max. Amp. Interrupted | C Phase Max. Amp. Interrupted | Operation | Time in Seconds to Open Circuit | Remarks |
|---|---|---|---|---|---|---|---|
| 150-amp., 500-volt, three-pole type Auto-U-Re-Lite W | 1 | 150 | 3,573 | 2,890 | O.K. | 0.0665 | ..... |
| | 2 | 150 | 6,050 | 5,000 | O.K. | 0.0915 | Carbon contacts slightly burned |
| | 3 | 150 | 7,320 | 6,730 | O.K. | 0.0749 | ..... |
| | 4 | 150 | 9,930 | 9,250 | O.K. | 0.1232 | Main contacts slightly burned |
| | 5 | 150 | 12,170 | 9,930 | O.K. | 0.0575 | Trip coils badly distorted; main contacts pitted; auxiliary contacts badly burned |
| | 6 | 150 | 12,300 | 11,450 | O.K. | 0.0657 | Turns in trip coils bent back to original shape before testing |
| | 7 | 150 | 13,560 | 12,300 | O.K. | 0.066 | Breaker put in as good shape as possible before testing; arcing contacts slightly burned |
| | 8 | 150 | 13,160 | 11,900 | O.K. | 0.074 | Main and carbon contacts slightly burned; auxiliary contacts burned, but not beyond repair |
| | 9 | 150 | 17,000 | 14,130 | O.K. | 0.074 | Potential taken across contacts of phase A |
| | 10 | 150 | 22,950 | 22,050 | O.K. | 0.074 | Dead short |
| 15-amp., 500-volt, three-pole type Auto-U-Re-Lite Jr. | 1 | 15 | 889 | 600 | O.K. | 0.074 | ..... |
| | 2 | 15 | 1,297 | 1,080 | O.K. | 0.0329 | ..... |
| | 3 | 15 | 2,160 | 1,760 | O.K. | 0.0246 | ..... |
| | 4 | 15 | 3,810 | 2,690 | O.K. | 0.0246 | Auxiliary contacts burned |
| | 5 | 15 | 3,950 | 2,890 | O.K. | 0.0246 | Main contact on middle pole burned due to auxiliary contact being opened too far. |
| | 6 | 15 | 5,770 | 4,230 | O.K. | 0.0166 | Auxiliary contact bent to normal position; all contacts cleaned and filed before being tested |
| | 7 | 15 | 6,050 | 4,325 | O.K. | 0.0246 | All contacts burned |
| | 8 | 15 | 7,490 | 5,580 | O.K. | 0.0329 | Potential taken across contacts of phase A |
| 150-amp., 250-volt, three-pole type Auto-U-Re-Lite Sr. | 1 | 150 | 775 | 1,267 | O.K. | 0.0665 | ..... |
| | 2 | 150 | 1,037 | 1,720 | O.K. | 0.1000 | ..... |
| | 3 | 150 | 1,756 | 2,350 | O.K. | 0.0416 | ..... |
| | 4 | 150 | 2,535 | 2,920 | O.K. | 0.0416 | Arcing contacts slightly burned |
| | 5 | 150 | 4,000 | 3,400 | O.K. | 0.0582 | ..... |
| | 6 | 150 | 5,860 | 4,320 | O.K. | 0.0334 | ..... |
| | 7 | 150 | 11,600 | 7,730 | O.K. | 0.0416 | ..... |
| | 8 | 150 | 11,830 | 10,250 | O.K. | 0.0333 | ..... |
| | 9 | 150 | 13,230 | 12,370 | O.K. | ..... | One phase burned up completely; two other phases welded shut |

In every case the maximum current interrupted and the time required to rupture the current were determined by oscillograms. The test connections and the methods for supplying energy are shown in the accompanying connection diagrams.

In the single-phase, 250-volt, short-circuit test two poles were placed in series giving twice the length of air break which would exist in a phase-to-ground fault but equivalent to the length of air break on a phase-to-phase short circuit. In the single-phase, 250-volt tests four breakers of 15, 30, 60 and 150 amp. nominal rating were tested. All were two-pole breakers except the one rated 15 amp.

The 15-amp. breaker opened eighteen short circuits varying from 250 to 7,300 amp. On two of these tests the breaker was closed in on a hot circuit and interrupted 2,900 amp. At the conclusion of the tests the breaker was still in operating condition, although the contacts were severely burned and the trip coils showed that severe heating had occurred.

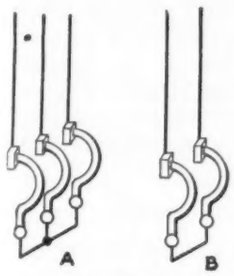



FIG. 2

Method of connecting inclosed air breakers for short circuit tests. A—For 500-volt, three-phase tests. B—For 250-volt, single-phase tests.

The 30-amp. breaker opened thirteen short circuits varying from 600 to 17,000 amp. At the conclusion of the tests the breaker would not close the circuit because of badly burned contacts and the trip coils were badly distorted.

The 60-amp. breaker opened seven short circuits varying from 200 to 8,500 amp. These were opened successfully, but on a final test at 9,300 amp. the contacts "froze" the breaker shut. At the conclusion of this test the contacts were burned and the overload coils were badly distorted.

The 150-amp. breaker opened five short circuits successfully. The last short circuit in this test was at 11,000 amp., and this was cleared in 1½ cycles.

### THREE-PHASE TESTS AT 500 VOLTS

Three three-pole breakers rated 15, 150 and 150 amp. respectively (Auto-U-Re-Lite, Jr., Auto-U-Re-Lite, Sr., and Auto-U-Re-Lite W) were tested on three-phase short circuits at 500 volts. The 15-amp. breaker opened eight short circuits successfully, the maximum being 7,500 amp. At the conclusion of the tests the breaker was found to be in good condition.

The 150-amp. breaker was rated for 250 volts, but was tested on 500 volts. It opened eight short circuits successfully, the maximum being 11,800 amp. On the ninth test, at 13,200 amp., one phase burned completely and the two others "froze" shut.

The 150-amp., 500-volt breaker successfully opened ten short circuits, the last one being 23,000 amp.

### CONCLUSIONS

These tests to what might be called destruction were made to fix limits in operation of inclosed air break switches. They showed that the breakers were rated very conservatively and indicated that with no changes in present designs they could be relied upon to rupture short circuits of the magnitude shown in Table I.

With slight changes in design indicated by the very severe duty, there are offered possibilities of increasing the rupturing capacity to still higher values.

The wider use of air breakers for heavy-duty service is warranted by the data obtained in these tests, and engineers in the industry should be able to use air breakers more intelligently for many heretofore debatable applications.

## Electrical Progress in Belgium

MOST of the electric light and power enterprises in Belgium have now published their reports for last year, and in each and every case a steady increase in demand is recorded. The Société Intercommunale Belge Electricité increased the capacity of its eight power stations from 124,250 kw. to 150,250 kw., and a further extension to 180,000 kw. is under consideration. The sales of energy were 36 per cent in excess of those in the preceding year and 85 per cent of the power supplied is for industrial purposes. To provide against interruption the central stations at Sweveghem, Alost and Malines are being linked together.

The Société d'Electricité du Bassin de Charleroi obtained a concession for the supply of energy to the commune of Courcelles and the concessions in four other localities were extended. The company now serves 36,073 consumers, representing a load of 51,892 kw., as against 33,155 and 43,006 kw. at the end of 1924.

Customers of the Société d'Electricité du Borinage increased from 22,790 to 25,685 and the load from 18,725 kw. to 21,520 kw. The company supplies energy to 42 localities and during the year installed 65 miles of distribution primaries, bringing the total to 692 miles.

Twenty-one districts were added to the area served by the Société d'Electricité du Nord de la Belgique, bringing the total to 114, with 555,000 inhabitants. Customers increased from 36,722 to 49,798 and the load from 50,459 kw. to 60,833 kw. The company has 1,120 miles of primary distribution lines in operation.

New distribution lines to the extent of 60 miles were added to the system of the Société d'Electricité de l'Est de la Belgique, bringing the mileage to 563. The number of customers is now 30,229, as against 27,564 a year ago, and the load is 29,603 kw., as against 25,682 kw.

A number of new districts were connected to the distribution system of the Société d'Electricité de l'Ouest de la Belgique. Nine localities are now supplied over 776 miles of line. The number of consumers advanced from 12,918 to 20,327 and the load from 17,958 kw. to 21,649 kw.

New high-tension primaries to the extent of 23 miles were installed by the Compagnie d'Electricité de Seraing, bringing the total to 177 miles, and during the same period the low-tension system was extended from 280 to 322 miles. The number of consumers increased by 8 per cent and the sales of energy by 11 per cent.

The Société d'Electricité du Pays de Liége experienced an increase of 12 per cent in the demand for energy. The Société Bruxelloise d'Electricité is increasing its capital from 15,000,000 francs to 22,300,000 francs with the object of installing a new 30,000-kw. turbo-generator set. Output last year increased 30 per cent. The sales of energy by the electrical division of the Société de Gaz et d'Electricité du Hainaut, notwithstanding a long strike, advanced 5 per cent, exceeding for the first time 100,000,000 kw.-hr. The company supplies electrical energy to 69 communes with a population of 312,000.

# Starting Compensators vs. Condensers

## Besides Improving Voltage Regulation and Line Losses, Investing the Saving from Omitting Compensator in Condensers Improves Full-Load Power Factor of Smaller Motors 8 to 10 per Cent and Starting Current 3 to 4 per Cent

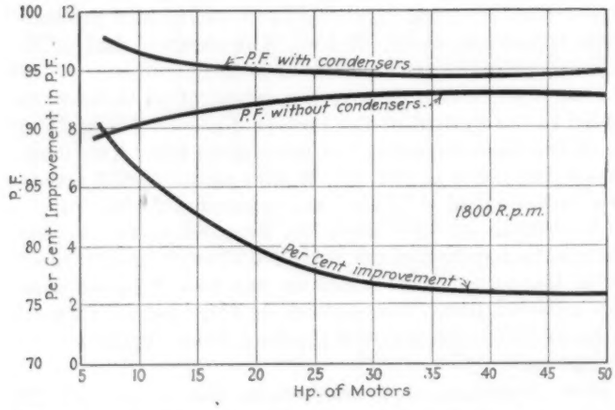
By PROF. BENJAMIN F. BAILEY
*Head of Department of Electrical Engineering, University of Michigan*

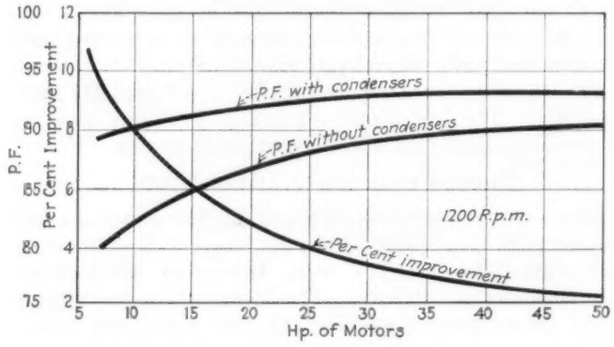
"ARE starting compensators needed?" was a question raised by the writer on page 250 of the Jan. 30, 1926, issue of ELECTRICAL WORLD, in which the effect of the use or non-use of this auxiliary equipment was considered with respect to motor heating, injury to the motor and connected apparatus, voltage regulation and lighting service. In general, it was pointed out that the starting current of a motor using a compensator may be greater than that without a compensator over the last 80 per cent of starting period, that the effect of the starting current on the voltage regulation is also more serious over a large portion of the starting period and that the aggregate effect on the lighting service is likewise more serious. The only advantage of a compensator, if any, in most installations is a slight reduction in starting current for a very short portion of the starting period. To obtain this slight reduction in starting current, the electric service company forces its customer to invest money in compensators or other starting devices.

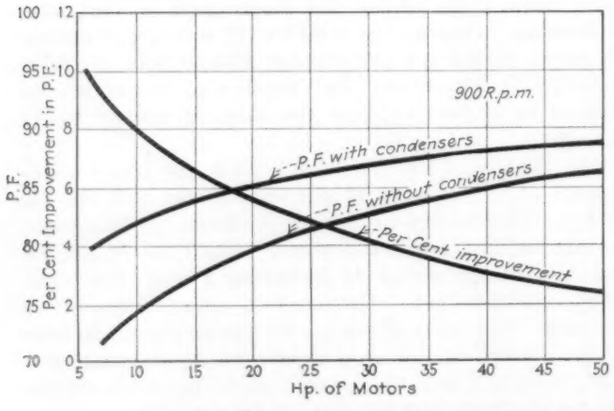
It is a fair question to ask if the money now invested in starting compensators cannot be spent to greater advantage. For example, if the money were invested in condensers, it would result in a reduction of current during the entire period of operation of the motors, including the starting period. The electric service company would benefit by the improved power factor and the customer by better voltage regulations and decreased losses in his wiring.

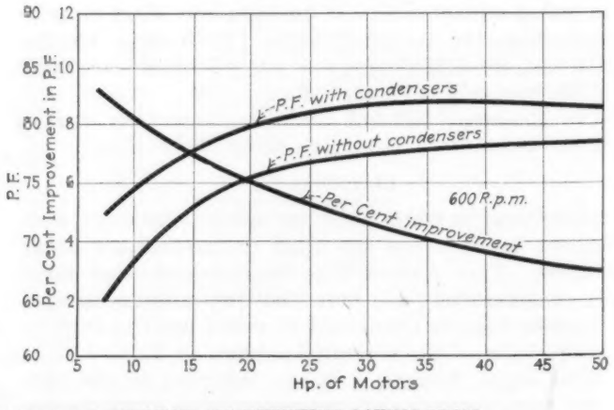
### ECONOMICAL LOCATION OF CONDENSERS

Whether or not condensers should be used for power-factor correction at the motor is question of relative cost. If they were sold at a very low price, they would undoubtedly be used almost universally for this purpose. The loss in a condenser is negligible and the chance of failure apparently small. The effect is a reduction of the line current and a corresponding reduction of line losses and an improvement in the voltage regulation of the line. The performance of the motor itself is




FIGS. 1, 2, 3 AND 4—FULL LOAD POWER FACTOR IMPROVEMENT OBTAINED BY INVESTING SAVING FROM OMITTING COMPENSATORS AND USING CONDENSERS
Based on three-phase, 60-cycle, 440-volt motors of 600, 900, 1,200 and 1,800 r.p.m.

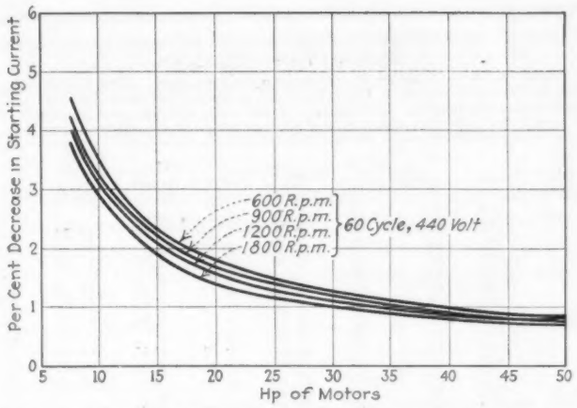



FIG. 5—PER CENT REDUCTION IN STARTING CURRENT, OMITTING COMPENSATORS AND PURCHASING CONDENSERS WITH MONEY SAVED

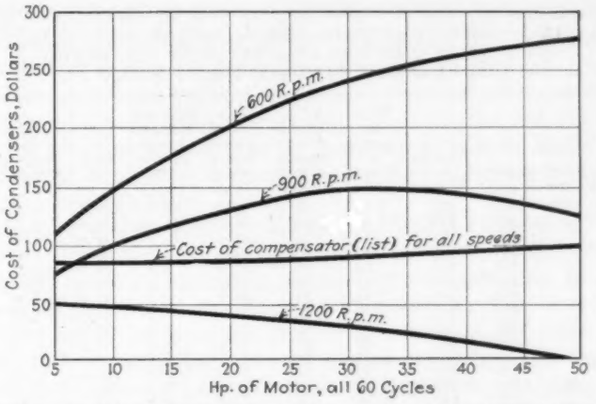



FIG. 7—COST OF CONDENSER TO RAISE FULL-LOAD POWER FACTOR TO 90 PER CENT

Based on $30 per kilovolt-ampere for 440-volt condensers (July, 1925), 220-volt condensers cost about $60 per kilovolt-ampere, and 550-volt condensers about $24.

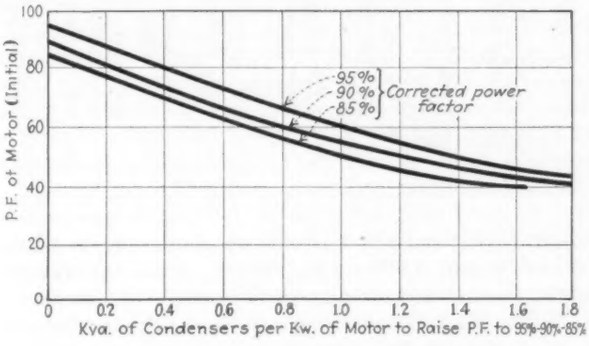



FIG. 6—CONDENSER CAPACITY NEEDED TO RAISE FULL-LOAD POWER FACTOR

For example, with a motor having a full-load power factor of 60 per cent, 0.82-kva. condenser is needed per kilowatt motor input to raise the power factor to 90 per cent.

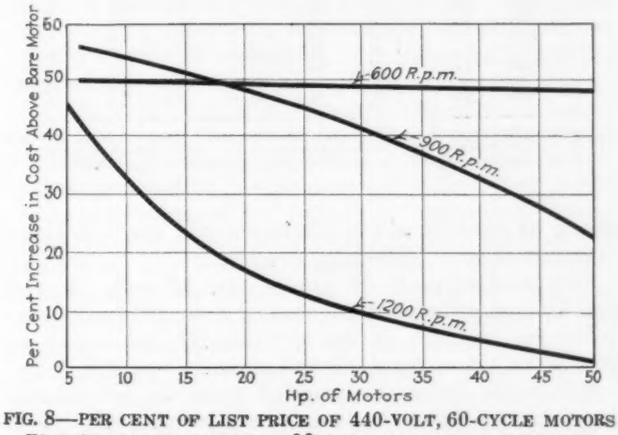



FIG. 8—PER CENT OF LIST PRICE OF 440-VOLT, 60-CYCLE MOTORS TO RAISE POWER FACTOR TO 90 PER CENT USING CONDENSER

not changed by the presence of a condenser except that the condenser tends to maintain the terminal voltage higher than it would otherwise be; consequently, the slip will be less.

### Computations on Standard Line of Motors

To investigate the possibility of obtaining greater benefits by investing for condensers the saving in compensators, computations were made upon a representative line of polyphase 60-cycle induction motors, the results of which are shown in Table I. The figures given for the approximate saving in cost by omitting the starting compensator make allowance for the substitution of a high-grade across-the-line starting switch with no-voltage and overload protection and oil-immersed contacts. The amount of condenser capacity which can be purchased with this saving is based on the unit price quoted at the present time by manufacturers of 440-volt condensers. The table also shows the improvement in full-load power factor which can be effected by the installation of these condensers. The condenser also operates to reduce the current during the starting period, as indicated, and thereby improves the voltage regulation and consequently maintains more uniform speed of the motor.

The substance of Table I is graphically depicted in Figs. 1 to 5, the first four figures showing the improvement in power factor by omitting the compensator and using the money saved to purchase condensers, whereas the last shows the percentage reduction in starting current due to the use of condensers purchased with the money saved by omitting compensators.

It does not pay to try to correct power factor to unity in this manner. The general opinion seems to be that a correction to about 90 per cent power factor is desirable. The kilovolt-amperage of condensers necessary to do this is equal to the kilowatt input to the motor multiplied by $(\sqrt{(1 - PF^2)} \div PF^2 - 0.484)$, the power factor value included being that of the motor at full load before correction. Similar expressions can be readily derived for other corrected values of power factor. The condenser rating in kilovolt-amperes per kilowatt input to a motor to raise the power factor to 85, 90 and 95 per cent is shown in Fig. 6 for different initial full-load power factors of the motor as it operates in service.

The ratings of condensers required to give 90 per cent power factor, their cost and a comparison of this cost with that of a compensator have been calculated for a typical line of 440-volt, 60-cycle motors rated at 7.5 to 50 hp., and are shown in Table II. If 220-volt motors are considered, the condensers will cost approximately twice as much as shown and those for 550-volt motors about 80 per cent.

Graphical presentations of the tabulated data are shown in Fig. 7. Since all manufacturers of motors have certain motors in their lines showing excellent characteristics and others not so good, the plotted points did not fall very closely on smooth curves. The curves were drawn to show the average values as

TABLE I—IMPROVEMENT IN POWER FACTOR AND STARTING CURRENT BY OMITTING COMPENSATORS AND BUYING CONDENSERS WITH THE MONEY SAVED

| Motor Rating | Speed, R.p.m. | *Saving on Starter | †Size Condenser at $30 per Kva. | Initial Power Factor at Full Load | Corrected Power Factor at Full Load | Improvement in Power Factor (Per Cent) | Kva. at Start | Reduction in Starting Current, Per Cent |
|---|---|---|---|---|---|---|---|---|
| 7½ | 1,800 | $55 | 1.83 | 90 | 97.8 | 7.8 | 48.4 | 3.8 |
| | 1,200 | $55 | 1.83 | 80 | 90.6 | 10.6 | 45.6 | 4.0 |
| | 900 | $55 | 1.83 | 72 | 82.5 | 10.5 | 42.8 | 4.28 |
| | 600 | $55 | 1.83 | 65 | 74.0 | 9.0 | 40.0 | 4.57 |
| 10 | 1,800 | $55 | 1.83 | 90 | 96.4 | 6.4 | 64.7 | 2.83 |
| | 1,200 | $55 | 1.83 | 83 | 90.6 | 7.6 | 60.8 | 3.01 |
| | 900 | $55 | 1.83 | 74 | 80.9 | 6.9 | 57.2 | 3.20 |
| | 600 | $55 | 1.83 | 67 | 74.3 | 7.3 | 53.3 | 3.44 |
| 15 | 1,800 | $55 | 1.83 | 90 | 95.1 | 5.1 | 97.0 | 1.89 |
| | 1,200 | $55 | 1.83 | 85 | 91.0 | 6.0 | 91.0 | 2.01 |
| | 900 | $55 | 1.83 | 79 | 85.7 | 6.7 | 86.0 | 2.13 |
| | 600 | $55 | 1.83 | 74 | 81.9 | 7.9 | 80.0 | 2.29 |
| 20 | 1,800 | $57 | 1.90 | 92 | 95.6 | 3.6 | 129 | 1.47 |
| | 1,200 | $57 | 1.90 | 88 | 92.7 | 4.7 | 122 | 1.56 |
| | 900 | $57 | 1.90 | 79 | 84.8 | 5.8 | 114 | 1.67 |
| | 600 | $57 | 1.90 | 78 | 83.9 | 5.9 | 107 | 1.78 |
| 25 | 1,800 | $57 | 1.90 | 91 | 94.0 | 3.0 | 162 | 1.17 |
| | 1,200 | $57 | 1.90 | 88 | 92.1 | 4.1 | 152 | 1.25 |
| | 900 | $57 | 1.90 | 75 | 80.9 | 5.9 | 143 | 1.33 |
| | 600 | $57 | 1.90 | 74 | 79.9 | 5.9 | 133 | 1.43 |
| 30 | 1,800 | $60 | 2.00 | 92 | 95.0 | 3.0 | 194 | 1.03 |
| | 1,200 | $60 | 2.00 | 89 | 92.5 | 3.5 | 182 | 1.10 |
| | 900 | $60 | 2.00 | 82 | 86.2 | 4.2 | 172 | 1.16 |
| | 600 | $60 | 2.00 | 78 | 81.9 | 3.9 | 160 | 1.25 |
| 50 | 1,800 | $68 | 2.27 | 93 | 95.3 | 2.3 | 324 | 0.70 |
| | 1,200 | $68 | 2.27 | 90 | 92.1 | 2.1 | 304 | 0.75 |
| | 900 | $68 | 2.27 | 86 | 88.3 | 2.3 | 286 | 0.80 |
| | 600 | $68 | 2.27 | 78 | 80.9 | 2.9 | 266 | 0.86 |

* Allowance made for substitution of high-grade across-the-line starting switch with no-voltage and overload protection and oil-immersed contacts.
† Unit price quoted by some manufacturers on 440-volt condensers.

TABLE II—SIZE OF CONDENSER NEEDED TO RAISE MOTOR POWER FACTOR TO 90 PER CENT

Based on 60-cycle, 440-volt, three-phase motors only. Cost is approximate cost to consumer—that is, list price—and is about the same for one, two or three-phase condensers. Condensers for 220 volts will cost approximately twice as much; for 550 volts about 80 per cent as much as for 440 volts.

| Motor Rating | Speed, R.p.m. | —Full Load— Eff. | P. F. | Kw. Input | Factor* Q | Condenser Kva. | Cost at $30 per Kva. at 440 V. | Cost of Starter |
|---|---|---|---|---|---|---|---|---|
| 7½ | 1,800 | 85 | 90 | 6.58 | 0 | 0 | | $85 |
| | 1,200 | 88 | 80 | 6.35 | 0.26 | 1.59 | $47.70 | $85 |
| | 900 | 86 | 72 | 6.52 | 0.48 | 3.13 | $93.80 | $85 |
| | 600 | 85 | 65 | 6.58 | 0.68 | 4.38 | $131.80 | $85 |
| 10 | 1,800 | 87 | 90 | 8.56 | 0 | 0 | | $85 |
| | 1,200 | 86 | 83 | 8.68 | 0.17 | 1.47 | $44.20 | $85 |
| | 900 | 87 | 74 | 8.56 | 0.42 | 3.59 | $107.50 | $85 |
| | 600 | 82.5 | 67 | 9.05 | 0.63 | 5.70 | $171.00 | $85 |
| 15 | 1,800 | 89 | 90 | 13.0 | 0 | 0 | | $85 |
| | 1,200 | 85 | 85 | 13.6 | 0.12 | 1.63 | $48.60 | $85 |
| | 900 | 86 | 79 | 13.4 | 0.29 | 3.88 | $116.00 | $85 |
| | 600 | 85 | 74 | 13.6 | 0.42 | 5.72 | $241.00 | $85 |
| 20 | 1,800 | 86 | 92 | 17.3 | | 0 | | $87 |
| | 1,200 | 89 | 88 | 16.7 | 0.05 | 0.84 | $25.20 | $87 |
| | 900 | 90 | 79 | 16.6 | 0.29 | 4.86 | $131.50 | $87 |
| | 600 | 88 | 78 | 17.0 | 0.32 | 5.36 | $160.20 | $87 |
| 25 | 1,800 | 89 | 91 | 21.0 | | 0 | | $87 |
| | 1,200 | 90 | 88 | 20.8 | 0.05 | 1.00 | $30.00 | $87 |
| | 900 | 89 | 75 | 21.0 | 0.40 | 8.8 | $263.00 | $87 |
| | 600 | 88 | 74 | 21.3 | 0.42 | 8.83 | $265.00 | $87 |
| 30 | 1,800 | 91 | 92 | 24.4 | | | | $92 |
| | 1,200 | 91 | 89 | 24.4 | 0.02 | 0.50 | $15.00 | $92 |
| | 900 | 90 | 82 | 24.9 | 0.20 | 5.00 | $150.00 | $92 |
| | 600 | 90 | 78 | 24.9 | 0.32 | 8.00 | $240.00 | $92 |
| 50 | 1,800 | | | | | 0 | | $98 |
| | 1,200 | 90 | 90 | 41.5 | | 0 | | $98 |
| | 900 | 89 | 86 | 41.8 | 0.10 | 4.18 | $125.00 | $98 |
| | 600 | 87 | 78 | 42.8 | 0.32 | 13.7 | $410.00 | $98 |

* See formula in text.

nearly as possible, and it is believed they are reasonably representative of American practice.

Comparative costs of motors and 220-volt, 440-volt and 550-volt condensers for raising their full-load factor to 90 per cent are shown in Table III, the condenser cost being taken from the smooth curves of Fig. 7 and consequently differing somewhat from the corresponding values of Table II. It may be noted that the figures used in the last column indicate the percentage that must be added to the cost of the bare motor to cover the cost of the condenser. These figures are shown graphically in Fig. 8. It will be noted that the percentage which must be added to the cost of 1,200-r.p.m. motors to raise the power factor to 90 per cent decreases very rapidly with the size of the motor. That for 900-r.p.m. motors decreases somewhat, whereas the additional cost for 600-r.p.m. motors remains practically constant at 50 per cent. If correction to 90 per cent power factor only is desired, no condenser is needed for 3,600 and 1,800-r.p.m. motors, since the full-load power factors are already 90 per cent or greater.

TABLE III—APPROXIMATE COST OF CONDENSER TO RAISE POWER FACTOR TO 90 PER CENT

Figures are for 60 cycles only. No condensers are needed w th 3,600 and 1,800-r.p.m. motor , as their power factors are above 90 per cent.

| Motor Rating | Speed, R.p.m. | Cost of Condenser (List) 220 Volt | 440 Volt | 550 Volt | List Price Bare Motor | Rates of Condenser Cost to Motor Cost at 440 Volts |
|---|---|---|---|---|---|---|
| 7½ | 1,200 | $100 | $50 | $40 | $129 | 0.388 |
| | 900 | 182 | 91 | 73 | 163 | 0.558 |
| | 600 | 264 | 132 | 106 | 252 | 0.523 |
| 10 | 1,200 | 94 | 47 | 38 | 152 | 0.31 |
| | 900 | 204 | 102 | 82 | 190 | 0.537 |
| | 600 | 296 | 148 | 118 | 293 | 0.505 |
| 15 | 1,200 | 90 | 45 | 36 | 194 | 0.232 |
| | 900 | 236 | 118 | 94 | 234 | 0.505 |
| | 600 | 350 | 175 | 140 | 346 | 0.505 |
| 20 | 1,200 | 80 | 40 | 32 | 232 | 0.173 |
| | 900 | 264 | 132 | 106 | 277 | 0.477 |
| | 600 | 400 | 200 | 160 | 399 | 0.501 |
| 25 | 1,200 | 70 | 35 | 28 | 267 | 0.126 |
| | 900 | 244 | 142 | 114 | 315 | 0.450 |
| | 600 | 222 | 222 | 180 | 489 | 0.455 |
| 30 | 1,200 | 60 | 30 | 24 | 303 | 0.099 |
| | 900 | 196 | 148 | 118 | 374 | 0.396 |
| | 600 | 480 | 240 | 192 | 495 | 0.485 |
| 50 | 1,200 | 0 | 0 | 0 | 381 | 0 |
| | 900 | 225 | 125 | 100 | 448 | 0.224 |
| | 600 | 550 | 275 | 220 | 574 | 0.479 |

Within the last year or so a number of manufacturers have placed on the market induction motors having double squirrel-cage rotors. These motors have the advantage that the starting current is very much reduced, so that they may be thrown directly on the line without the use of a compensator and still keep within the current specified by the N.E.L.A. However, these motors have the decided disadvantage that the running power factor is lower than that of a normal squirrel-cage motor. If provided with condensers to raise the power factor to at least as high value as that of the average squirrel-cage motor, it would seem that their use would be very advantageous.

Some manufacturers are already offering such motors as general purpose motors. If such motors are to be substituted in large numbers for the present squirrel-cage motors, the power-factor situation, already bad enough, is going to be much worse. Of course, one very obvious solution would be to raise the limiting starting current so that the ordinary squirrel-cage motor might compete on even terms with the double squirrel-cage motors.

In case condensers are used as previously indicated, it becomes a question as to whether they should be connected ahead or just behind the motor switch. If connected ahead of the switch, the condensers would stay on the line all the time and would tend to raise the average power factor of the entire installation. Therefore it would seem advisable that at least a certain percentage of such condensers should be permanently connected to the line. If this were done, the average power factor of the entire motor installation would be raised much more than the preceding figures would indicate. The effect would be more noticeable in case any of the motors were shut down during a considerable portion of the time.

# Letters from Our Readers

## Are Starting Compensators Necessary?

*To the Editor of the* ELECTRICAL WORLD:

In answering the above question five items must be taking into consideration—first, the type of drive; second, the load; third, the speed of the motor; fourth, the ratio of the unit motor to the total connected load; fifth, the difference in cost.

*Type of Drive*—Induction motors up to 100 hp. that are directly connected to their load through a coupling may in practically all cases be started without a compensator, or directly across the line, without any risk to the motor. As the majority of applications of this kind are centrifugal pumps, the load increases with the speed, and therefore full-load conditions are not reached until the motor is running full speed.

Motors connected to their loads through the medium of leather or other types of belting may be started across the line if the characteristics of the drive will permit. The same applies to chain-drive applications. If, however, the load is such that the belt slips to any extent or imposes undue strain on the chain, starting across the line will prove more costly than the renewal of compensator parts. It does not take long to ruin a badly slipping belt, especially if the travel in feet per minute is great.

Gear drives are not adapted for across-the-line starting, although in certain instances and on small sizes no trouble would be experienced. On the other hand, I know of several instances where the teeth have been broken from gears and pinions when starting the motor with the compensator on the highest tap, the load being extremely hard to start in all cases.

*Load*—Unless the load is very great, there is no real danger to the motor in across-the-line starting, and the writer can quote instances without number where with a compensator the handle has been thrown to the "run" position before the motor would start.

Some time ago a peculiar case of trouble was reported by an operator to the writer. A 50-hp., 720-r.p.m. induction motor driving two 56-in. circular saws and saw deck refused to start. The motor was protected by a 100-amp. fused service switch mounted on the wall near where the saw operator stood, while the compensator was at the bottom of the platform and just out of reach. The service man on opening the switch box to examine the fuses found that one of the blades was burned completely off. On investigation, it was found that the saw operator was in the habit of blocking the compensator handle in the running position and of starting the motor from the service switch. This method of starting had been going on for a considerable length of time without detriment to anything except the switch, although the starting duty of circular saws of this size is usually severe.

*Speed of Motor*—Any low-speed motor up to 100 hp. may be started across the line without exerting any undue strain on either the motor or apparatus it is driving. By a low-speed motor one of 720 r.p.m. and under is meant. Where the load is directly connected to the motor through a coupling, the speed does not signify.

*Ratio of Unit Motor to Total Connected Load*—Where a small industry is operated by a few motors, some of high and some of low rating, it is not always desirable to start the larger-size motors across the line, since it will tend to disturb the rest of the motors through the lowering of the voltage when a heavy rush of current is sent through the larger motor. This applies not only to the industry itself but to other small nearby industries as well, especially if the demand factors of the industries are high.

*Difference in Cost*—It is not practicable to start motors rated above 5 hp. by means of knife switches, either open or inclosed, unless the contacts are immersed in oil. It is therefore necessary to have some other means of starting if a compensator is not desirable, such means being an oil circuit breaker or an air breaker. With a 100-hp. motor starting across the line, at least a 200-amp. oil breaker is required, while if a carbon or air-break breaker is used, the rating must be increased to at least 300 amp., if the breaker is to stand up for any length of service. The question then arises, which is the cheaper and which will give better and longer service, the compensator or the breaker? As far as maintenance is concerned, if a substantial type of compensator—and there are several on the market—is used, the cost of upkeep is about fifty-fifty as far as the contacts are concerned, and if the compensator is not abused, the windings will be found to last for an indefinite period.

The main reasons for failure of compensator windings are leaving the handle in the starting position and water in the oil. With the present types of compensators, it is virtually impossible for the handle to remain in the starting position unless deliberately blocked in that position, which leaves, as the only other reason for failure, water in the oil. The water settling in the bottom of the oil tank forms a path across the contacts allowing a heavy current to flow continuously through the windings—one which, if left for any length of time, will burn out the windings. If proper caution is used that the compensator be mounted where water is not likely to drip on it and consequently get into the tank, this trouble will never occur. In a certain plant where there are over 150 motors of all sizes operating at 550 volts only two cases of trouble of this kind have occurred in the last four years, although 75 per cent of these motors are installed in damp places.

Provincial Paper Mills, Ltd.,
Port Arthur, Ontario, Canada.

H. E. STAFFORD,
Electrical Engineer.

## Electric Threshing Tested at Dayton Fourteen Years Ago

*To the Editor of the* ELECTRICAL WORLD:

On page 719 of the April 3 issue of the ELECTRICAL WORLD is an article describing threshing oats by means of an electric motor. This is by no means a new application of electric power. By referring to the ELECTRICAL WORLD, Vol. 60, No. 5, page 250 (August 3, 1912), an article will be found detailing the favorable results obtained by the Dayton Power & Light Company fourteen years ago. We feel that this early pioneer work of our company deserves some mention, particularly since the results accomplished at that date agree very favorably with those disclosed in the test made by the Adirondack Power & Light Company.

O. H. HUTCHINGS,
Vice-President and General Manager.
Dayton Power & Light Company,
Dayton, Ohio.

# Central Station and Industrial Practice

## Helpful Methods for Linemen

TACKLE blocks are as essential to overhead line construction as pliers, but common tackle is a frequent cause of accident. The wooden shells are likely to become broken after a short period of use and the small-diameter sheaves with their small bearing surfaces tend to wear the rope quickly and require more man power because of the friction. These disadvantages are not inherent to light-shell metal blocks with roller bearings and a safety link over the hook. The safety link will retain the clamps in the hook and the stationary end of the block will stay in its fastening.

Since the use of the hand axe on poles has been the cause of many accidents to both linemen and groundmen, it is advisable to replace its use in this position by a No. 2, double-faced engineer's hammer or tools of a similar shape. The habit of throwing small material or tools to men on poles should be discontinued and a bag employed for raising or lowering small material and tools. The bags can be made of nonconductive material such as canvas with wood or leather bottoms and rope or leather handles.

For grounding high-voltage lines, before work is done on them (unless live-line tools are used), a grounding chain should be used that has as high a conductivity as possible, good sliding qualities over the conductor and a non-snarling character. The flat-link arc lamp chain is not considered desirable for this purpose, as it will not slide over the conductors easily and has a low conductivity. During a current-capacity test on a short piece of galvanized chain of this character, 1,000 amp. was carried for about 1.2 seconds before the chain melted. A similar length of No. 3 copper-plated chain carried about 1,150 amp. for four seconds before breaking. Rapid oxidation of galvanized chains at high temperatures causes the zinc to ignite and hastens the destruction of the grounding chain.

To avoid the foregoing objections, the Wisconsin Power & Light Company employs a heavily copper plated No. 3 Elwell twisted-link machine chain. It is imperative that considerable stress be exerted and maintained on the grounding chains or the contact resistance between the chain and conductor and between links will be so high that the chain will be ineffective. Grounding chains approach the minimum resistance when subjected to about 50 lb. tension or more.

Tree-trimming tools having a wire, metal or other conducting tension member for operating the cutter should not be used, because accidents have occurred from this conducting member coming in contact with conductors of dangerous voltage.

Open-type disconnecting switches on overhead primary lines should be discouraged, as they add to the hazard of linemen. A disconnecting switch inclosed in a treated-wood or porcelain box is much safer and costs but little if any more. Sectionalization of high-voltage lines should be done by remotely operated switches the blades of which operate simultaneously. Such switches cost more than a set of single-pole disconnecting switches but they are worth more because of their convenience and safety. The metal operating handles of the switches should be grounded at the handle.

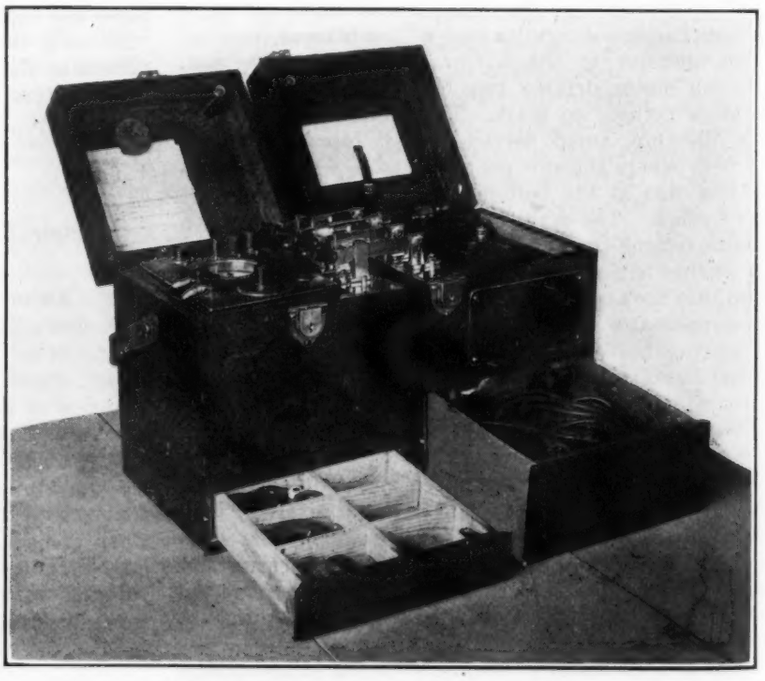
Rubber gloves, although quite commonly used, are not universally used. They should be given a high-voltage test about once a month, depending on the amount they have been used. Rubber goods deteriorate quite rapidly, therefore it is essential that they be examined each time before worn. Rubber blankets constitute an essential safety device for overhead line work and line hose and line hoods are also useful for covering the conductors and insulators.

These suggestions and opinions were obtained from E. J. Kallevang, chief engineer of the Wisconsin Power & Light Company, Madison, Wis.

## Favors New House-Meter Testing Outfit

BY J. T. SLOAN
Kansas Gas & Electric Company, Wichita

A NEW house-meter testing outfit is being used by the Kansas Gas & Electric Company, Wichita, which is suitable for testing all single-phase meters up to and including 25 amp. It can test 110-volt and 220-volt, two-wire or three-wire meters whether the neutral is brought out or not. Although it cannot be said definitely



HOUSE-METER TESTING SET IN TWO CASES

that this outfit will save any time over the old, if there is any difference it will be in favor of the new set. Furthermore, it is neat and compact; all wires are rubber covered, will not show dirt and wear and are concealed during transportation. Extra pivots are carried in a special oiled-felt holder that makes it unnecessary to touch them by hand. Extra jewels are also protected. Fuses and small repair parts are carried in other compartments and test cards are accommodated in the lid of the load box, face up so the tester can always tell where the meter to be tested is located. Cards can be seen through a glass window in lid. When the lids are closed and locked, the drawers are automatically locked, so a tester can leave the outfit anywhere without fear of someone tampering with the contents. No connections have to be made at the instruments. Heavy felt packing around the test meter protects it from jars.

The chief objection to the outfit is its weight—13 lb. more than rheostat outfit. But this load is evenly divided between two cases (20 lb. a piece), so it is not so noticeable unless the tests are badly scattered.

# Notes of Phase-Changing Auto-Transformers

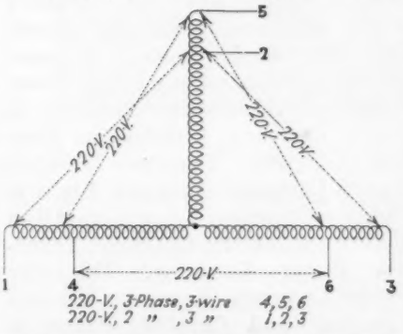
By H. M. Jalonack
Transformer Specialist General Electric Company

On some central-station systems it is sometimes desired to use three-phase motors on two-phase lines. In such cases, where the kilovolt-ampere capacity is 25 or less, a two-phase, three-phase line of auto-transformers proves extremely valuable.

They present an economical and efficient way of changing from one phase relation to the other. Their cost is small compared with straight transformers, the space they require is less than that taken by oil-cooled units and it is permissible to install them in buildings, factories, etc., where the fire underwriters would require fireproof compartments for oil-cooled units. Their losses, compared with the total kilovolt-ampere output of the unit, are small. They lend themselves readily to either open or conduit wiring.

It should be borne in mind, however, that there are certain precautions that must be taken into consideration in the application of these auto-transformers. If these precautions are not observed, the user may find himself in possession of apparatus that is entirely unsuited for his purposes, units that require other auxiliary apparatus to make them function or units that entirely disturb his regular routine of testing for grounds, short circuit, etc. Some of the more common misapplications of auto-transformers and some of the precautions to be observed are covered by the following cases.

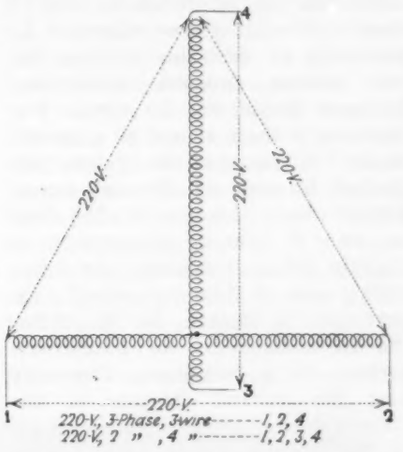
1. *Two-Phase, Three-Wire and Four-Wire.*—When transforming from three-phase to two-phase or vice versa, it is absolutely necessary to know whether the two-phase is three-wire or four-wire. The connections of auto-transformers for three-wire, two-phase are entirely different from those for four-wire, two-phase, as an examination of Fig. 1, illustrating the former, and Fig. 2, illustrating the latter, will show. Sometimes a superficial examination of the two-phase system will show a four-wire system, but somewhere in the factory two of the middle wires will be joined, making a three-wire system and preventing the auto-transformer from functioning correctly. If the wiring arrangements permit, it is desirable to make the whole system three-wire, as there will then be no doubt as to the proper operation of the unit.




SCHEME OF THREE-PHASE, THREE-WIRE TO TWO-PHASE, THREE-WIRE AUTO-TRANSFORMER

2. *Kilovolt-Ampere Frequency—Type of Wiring.*—It is, of course, necessary to know the kilovolt-ampere output of the unit (which is usually estimated at 1 kva. per horsepower), the frequency of the circuit and whether the units are for conduit or open-type wiring.

3. *Two-Phase Motors with Interconnected Phases.*—Where two-phase motors are supplied from a three-phase circuit through an auto-transformer, the phases of the motor cannot be connected together internally. This does not refer to three-wire versus four-wire as covered by case 1, but to the actual cross-connection of the motor windings. Some motors of this type were formerly built by motor manufacturers, and although they are no longer built, some of the old ones are still in service. Neither the three-wire nor the four-wire auto-transformers can be used with such motors, and it is necessary in this case to furnish straight transformers. When three-wire, two-phase wiring is used throughout, this is a positive assurance that the motor phases are not cross-connected, as a three-wire connection would result in a short-circuited motor winding.




SCHEME OF THREE-PHASE, THREE-WIRE TO TWO-PHASE, FOUR-WIRE AUTO-TRANSFORMER

4. *Two-Phase Generators with Interconnected Phases.*—Where three-phase motors are supplied from a two-phase circuit, it is necessary to see that the generators are not cross-connected in the manner referred to in case 3. There are still a few cross-connected generators in service, and this would result in the same difficulties as experienced in the previous case. Should there be stepdown or insulating transformers in the circuit between the generator and the auto-transformer, as there would be if the distribution were at 2,300 volts, two-phase, this difficulty would be at once removed.

5. *Two-Phase, Five-Wire Networks with Interconneted Phases.*—In some cases the secondaries of

both main transformers have their neutrals grounded, which makes the secondary a two-phase, five-wire system. Such an arrangement is to be found in Philadelphia and in the Bronx section of New York City. Here again the phases are interconnected and auto-transformers cannot be used.

6. *Where It Is Desired to Keep the Two Phases Separate.* — All auto-transformers for two-phase, four-wire service have the phases interconnected, as reference to Fig. 2 shows. In all cases where it is necessary or desirable to keep the two phases isolated, auto-transformers should not be used. For instance, if there should be a ground on the "A" phase of the system, this ground because of the auto-transformer connection would also show up on "B" phase, although to a slightly different degree. An interesting case of this was recently experienced in Beacon, N. Y. After the installation of an auto-transformer on a two-phase, four-wire line, the ground detector at the station showed grounds on one phase of the system. Subsequent investigation proved there were no grounds on the system. The ground detectors were of the electrostatic type, one on each phase. The plates were balanced so that the action of the ground detector depended on the maintenance of an electrostatic neutral half way between the lines of each phase. When the auto-transformer was connected in the circuit, a new neutral for the system was established. This neutral point was an equal distance from the plates on the detector on "A" phase, but was closer to the plate on one line of "B" phase than to the other. One phase, therefore, indicated a false ground. Under certain conditions a real ground on the system made the reading on "B" phase less, under other conditions greater, and in both cases a ground was shown on phase "A." The value of the ground detectors was therefore practically eliminated.

7. *Grounded Systems.* — In some parts of the country a two-phase, four-wire system with one phase grounded is used. This ground is put on in accordance with underwriters' requirements. An auto-transformer for four-wire service installed on such a system is satisfactory until another phase is accidentally grounded, in which case the system would become a three-wire, two-phase system and the auto-transformer would burn out. Such a case was actually found recently. The underwriters were unwilling to have the ground left off of one phase, and the owner of the building was unwilling to keep temporary grounds off of the rest of the system. Furthermore, the building electrician was anxious to keep the place isolated, since, because of the complicated wiring throughout the building, it was necessary to check the wiring with lamps. This was prevented by the interconnection of the phases. In addition to this a ground on the three-phase side of the auto-transformer would short circuit part of the winding. In this case it was necessary to reisolate the phases by means of insulating transformers placed ahead of the auto-transformers.

# Interconnection in the South

### Divisional N.E.L.A. Report Points Out How It Has Worked to Advantage of All Southern Companies

WHAT it means to the light and power companies in the Southeast to be interconnected was described in a very complete report of the superpower survey committee of the Southeastern Division, N.E.L.A., presented recently at the annual meeting at Pinehurst. This report was given by J. V. Strange, chairman of the committee and operating manager of the Carolina Power & Light Company, and shows how in the territory embracing the states of Mississippi, Alabama, Tennessee, Georgia and North Carolina power has been and is now being exchanged among separate and distinct operating companies. While the whole electrical world is being regaled with much discussion of the question of superpower or what is sometimes called giant power, the report shows that this idea is being put into practice in quite an unostentatious way in the Southeast district.

The principal power companies in this territory are the Southern Power Company, Alabama Power Company, Georgia Railway & Power Company, Central Georgia Power Company, Columbus Electric & Power Company, Birmingham Electric Company, Tennessee Electric Power Company, Memphis Light & Power Company, Augusta - Aiken Railway & Electric Company, Tallassee Power Company, Tidewater Power Company, Kentucky Utilities Company and Carolina Power & Light Company. All of these companies are so physically constituted as to permit of the interchange of power one with another and during the past year all of these companies took advantage, in varying degrees, of this fact. The first interconnection between the large systems was made in 1912 between the Georgia Railway & Power Company and the Central Georgia Power Company.

In August, 1923, there was organized what is known as the operating sub-committee of the Southeastern power companies. This committee consists of an operating representative from each of the companies, the committee meeting periodically during the year for the purpose of discussing operating problems and particularly those subjects that have a bearing on the interchange of energy among the respective systems represented in the committee. Such subjects as daily and peak loads, rainfall data of a comparative nature, conditions of storage reservoirs and river flows, the relation between amounts of energy generated by hydro and steam, amount of energy being interchanged among the respective systems and advance information as to construction of additional generating and transmission facilities that may affect the situation on the whole, with particular reference to the subject of interchange of power, are discussed and reduced to the form of data that are made available for all operating companies thus concerned.

Certain yearly statistical data are assembled by the secretary of the operating sub-committees, and these data, although available for only the past three years, are becoming of more and more interest, since by this means the increasing importance of this scheme of interconnection is being brought to the attention of all the companies represented. In 1923, the first year in which data as to the amount of electrical energy exchanged among these companies were available, there was approximately 261,000,000 kw.-hr. interchanged among the various companies making up this interconnected system. In 1924 this figure increased to approximately 283,000,000 kw.-hr., although the year 1924 was an exceptionally

favorable one from the standpoint of river flow and hence the demands of the exchange system were not as great as otherwise they might have been. In 1925, however, with water conditions subnormal and in fact unprecedentedly low, there was exchanged among the various companies approximately 567,000,000 kw.-hr.

According to the report, the total generation of all of these companies in the Southeast for the year 1925 amounted to approximately 3,500,000,000 kw.-hr., of which about 60 per cent was hydro-electrically generated, the remaining 40 per cent being produced by steam. The estimated simultaneous peak load of all these companies was 800,000 kw. The total installed generating capacity amounts to 1,378,000 kva., of which 913,000 is in hydro capacity, whereas the remainder of 465,000 is in steam capacity. All of the principal interconnecting lines are operated at from 100,000 volts to 110,000 volts. Since these figures as to generation indicate that about 7 per cent of the total kilowatt-hours generated in the United States during the past year was generated by these interconnected companies of the Southeast, it becomes apparent that superpower is already here in no small degree.

In the southeastern district conditions seem to lend themselves in an ideal way in favor of putting into practice the idea of superpower. The flow of the rivers is flashy; most all of the hydro-electric generation is of comparatively low head, thus requiring the use of much water; adequate storage facilities are expenpensive and in many instances difficult to obtain at any reasonable cost; with all this, the rapid industrial development that has in recent years been going on in the South is creating generally throughout the territory fast-growing demands for electric service. As the companies are dependent for water entirely on the rainfall, having no water storage in the form of snow such as is to be found in other sections of the country, and moreover, in view of the fact that generally the summer rains fall in spots in the form of heavy showers, the companies find as a practical situation that one section of the territory may get adequate relief through rain at one time, whereas the next time another section of the territory may be thus benefited. Through interconnection it is possible to accomplish to a considerable degree a leveling out of rainfall, thus permitting the conservation of resources to the advantage of all concerned.

## Industrial Trucks Used in Madison Square Garden

HOW the Madison Square Garden, New York, said to be the world's greatest sport center, is changed from a skating rink to a boxing match arena over night provides an interesting example of modern material-handling methods applied to sports promotion.

This transformation scene takes place every night over a period as long as a week at a time. For instance, following a hockey match on one night there may be a convention or an athletic meet the following, with a bout on the third evening. Then it is necessary to convert the arena into a rink again for one night, and so on from one to another.

Modern factory efficiency enters into this transformation with the use of two electric industrial trucks, each operated by a twelve-cell MVA-17 plate Exide-Ironclad battery. Immediately following a hockey game, warm brine is circulated through the refrigeration pipes, which are imbedded in the concrete floor. The warm brine quickly loosens the ice and the two industrial trucks then get busy. One truck is equipped with a plow for breaking up the ice and the other with a scoop, which shovels the ice into a convenient opening in the arena and onto a truck below. The ice, which is 1½ in. thick and covers more than 24,000 sq.ft., weighs 85 tons. J. J. McNally, superintendent of the arena, states that the two trucks clear the entire arena in two hours and that without these trucks it would require at least 30 men working from eight to ten hours to clear the ice away. As soon as the ice is cleared away, the two trucks carry the chairs and other furniture into the arena.

CLEARING ICE FROM MADISON SQUARE GARDEN RINK WITH ELECTRIC TRUCKS

## Birds and Transmission Lines

THE birds in the United States are not the only ones that manifest a fondness for transmission lines and cause line maintenance men to curse the ornithological kingdom. Storks in Morocco quickly discovered that the towers of the 60,000-volt transmission line between Casablanca and Rabat furnished more stable foundations for nests than the trees and chimneys they were used to. Although the nests themselves caused no trouble, the personal habits of the birds caused many insulator failures. The towers were finally provided with smooth surface shields on which the storks could find no footing and they contented themselves with the perches which were built adjacent to the line.

In Switzerland the hawks quickly appreciated the value of the top of a pin-type insulator on a high pole as an observation post for spying out their prey. The familiar falling swoop which characterizes these birds usually brought their wings across two conductors and the results were disastrous to themselves and highly annoying to the power companies. A "chevaux de frise" effect on the tops of the insulators cured this condition.

# Commercial Activities and Public Relations

## First Stock Sale Adds 11,000 Customer Owners

THE British Columbia Electric Power & Gas Company, Vancouver, B. C., met with more than usual success in its first customer-ownership campaign conducted between March 15 and March 20. This company is a subsidiary of the British Columbia Electric Railway Company and was organized for the sole purpose of customer ownership, since the senior company is an English corporation and its interest and dividends are subject to the English income tax, thereby making it impracticable to sell its stock in Canada.

Applications were received for a total of $7,155,300 of 6 per cent cumulative preference shares in five and one-half days. About 11,000 customer owners were added during the sale in a territory with a population of 350,000. Since the authorized issue was only $5,000,000, applications for more than $2,000,000 were refused and on final allotment no application was accepted for more than ten shares. A syndicate of local bond dealers underwrote $1,500,000 of the issue, and the remaining $750,000 of the original amount offered for sale was to be handled by the company employees. The employees brought in 10,247 applications for a total of $5,655,300, and the bond dealers, selling their allotment at the same time, brought in more than 1,000 applications. Out of a total of 2,985 permanent employees 1,670 applied for a total of $603,000 worth of stock for themselves.

It was originally planned to open the sale on March 20, although incorporation of the new company was not accomplished until March 4. Knowledge of the incorporation and its purpose having spread, without any direct publicity campaign there arose such a demand for stock that it was impossible to hold back the sale. Employees and brokers, therefore, were allowed to take applications on March 15, though no advertising of the campaign was started until March 17. The brokers' allotment was entirely sold in two days and the employee allotment in about 24 hours. When the advertising began to be felt on the third day of the sale, the applications doubled, pouring in on the third day to the extent of $1,400,000.

Local newspaper comments declared that the oversubscription was an indication of the confidence in the integrity of the company. The city of Victoria, with a population of 50,000, applied through employees for more than $1,000,000 of the issue. The success attained was not unexpected, but it is believed that this campaign attained something of a record for enthusiasm and success not only in Canada but throughout this continent. The president of the company is George Kidd and the campaign is in charge of William Saville, general secretary; D. H. Adams, comptroller, and the publicity department, J. Lightbody, manager.

## Refrigerator Business Requires Organized Effort

### New Jersey Central-Station Company Attacks Refrigerator Selling and Maintenance with Plans Laid and Trained Forces Disposed to Best Advantage

REALIZING that the sale, installation and servicing of electric refrigerating units are functions entirely outside the experience of the normal customer contact division of the central station, the Public Service Electric & Gas Company of New Jersey has organized a distinct refrigeration department. This company has the exclusive agency for the products of the Kelvinator Corporation, and all of the refrigeration sales efforts are concentrated thereon.

The sales executives of the company claim, and, one would admit, reasonably, that such centering of effort in sales as well as in installation and servicing results in a higher degree of consumer satisfaction than would the attempt to handle several different makes. Another reason that led the sales officers of the Public Service company to form a separate department was the conviction that the success of the whole refrigeration business, so far as the central station is concerned, depends entirely upon the men who in selling, installing and servicing refrigerators represent the central station to the consumer. It was felt that these men must know their business from alpha to omega, that on the particular type of refrigerating unit sold each installation and service man should be able to perform any repair operation or to answer any question the user might ask. This ideal of service requires devotion to refrigeration to the exclusion of other interests.

In order to secure that uniformity of treatment of all customers which alone results in enduring respect and confidence and which is possible only when all the men who make customer contacts are fully informed on the product they handle and are perfectly capable of keeping it in exact operating condition, each man who is concerned with refrigeration business is furnished with a manual that covers every phase of refrigerator sales, installation and service. This manual was compiled and in great part written by F. D. Pembleton, assistant new-business agent of the Public Service Electric & Gas Company.

#### QUOTING THE MANUAL

To quote from the introduction to the manual:

"The sale of an appliance like a refrigerating unit, which requires so much attention to details, would result in failure if the work were not carefully organized and planned. The instructions contained herein represent an effort carefully to organize and systematize the basic details and operations and present them in a manner which makes the information always and easily accessible. It is not expected or intended that the plan will be read and laid aside, but that it will be lived with and worked with until all the details of the refrigeration business become a part of the conscious knowledge of every one connected with it."

The manual is divided into eight sections, which cover, in the order given: "Agreement for the Sale of Refrigerating Units," "Agreement

for the Sale of Refrigerator Boxes," "Sales Organization and Responsibility for Sales," "Installing and Servicing Refrigerating Units," "Selling Prices for Refrigerating Units and Boxes," "Accounting Plan for Installing, Repairing and Servicing Refrigerating Apparatus," and a collection of catalogs and instruction books covering completely the line of apparatus handled. In order to make any piece of information easily available, the book is also cross-indexed alphabetically.

### AGREEMENTS WITH MANUFACTURERS

Sections 1 and 2 are devoted to explanations and expositions of the agreements betwen the Public Service company and the Kelvinator Corporation relative to the terms of the contracts for the exclusive sale of the Kelvinator products in the Public Service territory. These agreements cover in detail the methods of arriving at discounts proportionate to the number of units sold during the period of one year, different plans for the sale of refrigerated cabinets for commercial use according to whether the transactions are handled by the central-station company, the Kelvinator Corporation or its agents, arrangements for the display of these larger units at designated salesrooms of the Public Service company, sales of Allen-Kelvinator water coolers, sales of Seeger and Leonard refrigerator boxes, and methods of delivery of these boxes and their display.

The third section is concerned with selling plans. The various payment arrangements are detailed —cash, terms and quantity prices. Refrigerator boxes are sold for cash only. On account of the comparatively high prices of refrigerating apparatus, sales efforts are directed only to such prospects as have unquestioned credit rating. Various discounts are allowed to architects, builders and contractors.

Section 4 covers sales organization and the responsibility for sales. In the Public Service sales organization there are 24 refrigeration representatives located in various towns and cities in the company's territory. The representatives are assigned to districts in the proportion of one representative to every 3,000 prospects. Prospects are listed from the company's accounts and an effort is made to limit prospects to those having an income of $7,500 or more per year. Qualifications of refrigeration representatives are stated and the limitations of their efforts are defined. Each company district is assigned a certain sales quota.

All refrigeration representatives in a district report to the local sales agent in a group every morning and receive general instructions covering the work for the day. At these meetings each representative is given a list of at least ten prospects for the day and is also given the names of three owners of refrigerators on whom he must make a call of inspection and, if possible, secure from them the names of interested people of their acquaintance. The afternoons of each day are devoted to following up and closing sales to prospects secured from the previous morning's solicitation.

At times and for limited periods the usual sales plan is to be varied by the employment of the Kelvinator book. This book is a beautifully printed and illustrated volume entitled, "From Cave to Kelvinator." It is an expensive thing and is not given to the prospect. It is delivered by A.D.T. messenger to the home of the prospect with the information that a Public Service company representative will call for it in a few days after the members of the family have had an opportunity to read it. The salesman thus, in nine cases out of ten, finds the prospect already somewhat informed on refrigeration, for the book is so attractive that any person would be dull indeed not to be tempted at least to look at the pictures.

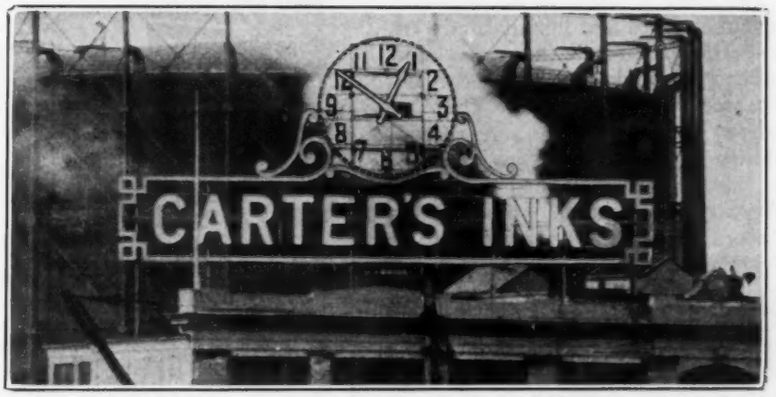
All representatives are protected for a period of 60 days on each prospect with whom they have been in touch. They are encouraged to use the telephone for making first contacts and for retaining touch with prospects.

### COMPENSATION OF REPRESENTATIVES

Representatives are guaranteed an income of $125 for the first month of their employment. After this period they are supposed to be able to make an equivalent or greater amount from commissions on sales. The representatives are held responsible for sales until one-third of the total amount of a sale is collected. Each representative and merchandise assistant in every district is required to study and pass an examination in the course on Kelvinator salesmanship conducted by the Kelvinator Institute. On every third Saturday morning in the month refrigeration sales meetings are conducted by the assistant new-business agent and by a representative of the Kelvinator Corporation in the auditorium of the main office at Newark.

The installation and servicing of refrigerating units is treated in the fifth section. An installation and service department extending throughout the entire territory is maintained by the company. Three months' free service is given from the date of each installation. After

## $8,000 Electric Sign Faces Cambridge Traffic Route




A STRIKING electric sign of the clock type has recently been installed by the Carter's Ink Company, Cambridge, Mass., facing the Charles River Basin, Esplanade and main traffic highway between Boston and the university city. The sign contains 1,300 lamps aggregating 14.6 kw. connected load, and is 90 ft. long, weighs about sixteen tons and cost, installed, about $8,000. The diameter of the clock is 20 ft. 6 in., and the letters in the sign are 8 ft. high. The sign is of the flashing type, with traveling border, and the cost of operation per month on the lines of the Cambridge Electric Light Company is about $100. It was designed and built by C. I. Brink, Boston. R. H. Bowman, illuminating engineer Cambridge Electric Light Company, represented the utility in the matter.

this period service is charged for, with materials and parts at list prices and labor, exclusive of traveling time, at $1.50 per hour. It is intended that service will be provided within 24 hours of the call.

The organization of the installation and service department includes a general installation and service representative in charge of a number of installations and service men located at designated points in the company system. At the present time there are thirteen service men solely engaged in refrigeration work. In addition to these the regular repair men in all of the districts are to be trained in refrigeration work and encouraged to take an interest in it. Each service man is equipped with an automobile in which is carried a supply of all removable and interchangeable parts and a tank containing a quantity of prepared calcium chloride brine together with a complete set of tools required for refrigerator maintenance. Each district will carry in addition to the supplies on each automobile a complete stock of repair parts and materials. A plan is in preparation whereby all installations are to be inspected at regular three-month intervals, these inspections to be paid for by the customer at the rate of $6 per year and to include servicing, adjusting and oiling. Instructions are given for the ordering of special units for places where the regular types would be unsuitable.

### Qualifications of Men

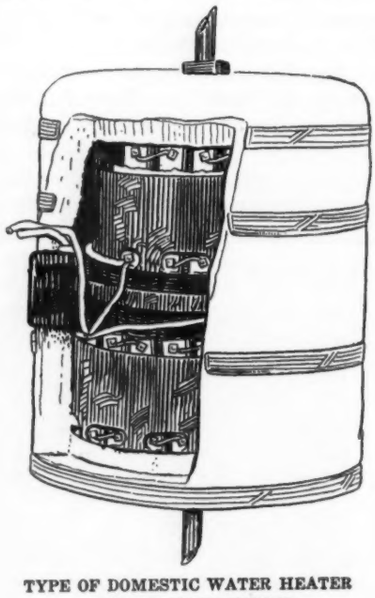
The kind of men to be employed for this service and installation work is specified to include those who know the country and can drive a car and who have had experience that requires resourcefulness and responsibility in some form of maintenance or installation work over a period of years—for example, marine engineers, machinists, plumbers or steam or gas fitters. Married men are preferred. The first two weeks of a service man's employment are spent in the New York shop of the Kelvinator Sales Corporation, following which a month is spent in working with a competent service man already on the staff. After this preparation the new man goes out alone if his work has been satisfactory. Rules for the conduct of the service men while on customers' premises are given and detailed instructions for the installation and testing of the machine are provided. Provision is made for technical studies of the theory of refrigeration and report of extraordinary and new conditions that may arise.

The sixth and eighth sections are respectively a list of selling prices and a collection of catalogs covering the entire Kelvinator line.

The seventh section is a detailed instruction to all division agents and salesmen covering the accounting method for sales, installation and service of refrigerating equipment. Detailed descriptions of types of forms and their uses and the routine to follow in every customer transaction are given. The methods for determination of charges and for the acounting of units, tools, materials and supplies carried in stock are prescribed. The disposition of expenses, salaries and commissions and of account collections is detailed.

## Water Heating—The Key to Electric Range Sales

WATER heating is, in many cases, the key to the all-electric household service, contends D. L. Cash, commercial manager of the



TYPE OF DOMESTIC WATER HEATER ADOPTED IN ROCKFORD

Rockford (Ill.) Electric Company, who maintains that it is certainly the key to electric range sales. If other service must enter the basement to take care of water heating, the sale of the three-wire service and the range for the kitchen is a great deal more difficult. But if a three-wire installation can be offered to handle the entire domestic service—cooking, water heating and refrigeration—the utility has a mighty strong sales appeal to architects, builders and home owners.

A 15-gal. automatic water heater has been adopted at Rockford for average home requirements. It demands 6 kw., produces 30 gal. of 112-deg. water for tub or shower, 15 gal. of 150-deg. water for washing machine and abundant 160-deg. water for all faucets, dishes and lavatories. It regenerates completely in approximately 30 minutes. For the first 24 hours the heat lost in the storage water is less than 1½ deg. per hour. According to Mr. Cash, the cost installed is less than automatic flame heaters of the same average capacity and its average consumption will range from 175 to 250 kw.-hr. per month in the average home with a family of four adults.

Since electric water heaters are considered a plumbing appliance rather than an electrical device in Rockford, the utility has organized the local plumbers, after allowing them to sell themselves on the efficiency of the appliance, into a resale organization to make the heater available to the public through the plumbing shop.

## Calling Attention to Company Progress

THE Ohio Public Service Company has recently issued to its customers a year book entitled "Progress," which is designed to show the remarkable strides the company made during the year. It differs from the usual type of year book, because, in addition to being well illustrated, it includes a number of colored charts and figures that enable the layman who is a customer and perhaps a stockholder of the company to visualize the actual physical and financial conditions at present and the progress the company hopes to make during 1926.

The way in which revenue was derived and expended, the growth of gross revenue and earnings over a period of years, the steady increases in number of customers, electric, gas and railway sales, and plant investments are graphically portrayed in such a manner that each customer will be able to see that the utility is enjoying a healthy growth and that the company's affairs are being administered in a conservative fashion. A complete system map is also included and plans are outlined for new transmission lines and station additions during 1926.

# Digest of Electrical Literature

## Hydro-Electric Development and Steam Equipment

*Power Stations and Their Equipment.*—W. M. SELVEY.—This is a review of progress. The author takes as an introductory simile a series of waves, the one held to be most in evidence being that of high steam pressure. This wave was preceded by the wave of high superheat, which was preceded by the waves of low exhaust pressure and increased blade speed. Tied in with the idea of high steam pressure are the uses of pulverized fuel and of the regenerative heat cycle. The author sees as the boiler of the future one with small heating surface, large superheaters, a large regenerator, powerful fans and pulverizers. Reference is made to the "saurian" type of plant, which has been developed in the United States and has also been largely used in France. The author uses the word "saurian" as referring to size. He remarks that the application of new ideas in plant design permit the use of a steam cycle which closely approaches the fundamental Carnot cycle. Power-station design is discussed with reference to number of boilers per turbine, fuel handling for stoker-fired and pulverized-coal installations, condensing-water supply and methods of screening and possible developments in plant-location requirements due to low-temperature carbonization. The modern tendency for sectionalizing power plants into fuel-handling, turbo-boiler and electrical switching units is adverted to. In the matter of boiler plants the location and design of superheaters is discussed, as well as the developments in boiler design due to the use of high pressures. Particular consideration is given to combustion-chamber construction in regard to the decreasing importance of brickwork problems and to the development of water-cooled furnace walls. Regarding turbines, reference is made to the opinion of A. E. G. engineers in summing up the discussion at the high-pressure steam conference of 1924, which said that there were no practical advantages in the use of steam pressures over 60 atmospheres or 900 lb. in condenser stations. This limit is fixed by economic considerations. The multiple-casing-design turbine is stated to have simplified production problems for the manufacturers. Passing on to condensers, the author reviews the changes which have lately been made and those which are in immediate prospect. The advance may be summed up by viewing the future condenser with somewhat smaller shell and very many fewer tubes. Much progress has been made in alternator design. One of the principal points of improvement is that of ventilation with its attendant problem of cooling. Other features are buried temperature detectors built into the machine, magnetically closed slots and the use of non-magnetic cast iron for end rings. The article closes with short discussion on power-station auxiliaries and switchgear and a general consideration of radical departures from accepted practice.—*Journal of Institution of Electrical Engineers*, London, April, 1926.

*Sherman Island Dam—Part I.*—A description of the design and construction features of the Sherman Island hydro-electric power station of the International Paper Company on the Hudson River. The plant has an ultimate capacity of 50,000 hp. This article gives the construction and design of the dam in detail and is profusely illustrated.—*Engineering (England)*, April 23, 1926.

## Generation, Control, Switching and Protection

*Grounding System for Generating Stations and Substations.*—W. W. LEWIS.—The recommendation is made that a common-ground bus should surround the building or substation structure and methods are described in detail for grounding various equipment. Driven pipes are preferred over other forms of electrodes such as buried plates, the comparatively low cost and favorable resistance and reliability being the deciding factors. Artificial treatment of soil to reduce its resistivity by the use of some solution such as sodium chloride (NaCL), calcium chloride ($CaCL_2$), sodium carbonate ($Na_2Co_3$) or copper sulphate ($CuSO_4$) and the use of overhead ground wires are also discussed.—*General Electric Review*, April, 1926.

## Transmission, Substations and Distribution

*X-Ray Analysis of Wooden-Pole Conservation.*—C. SCHANTZ.—The method most frequently used to conserve wooden poles for electric lines is impregnation with corrosive mercury ($HgCl_2$). The author found that wood treated in this way is decidedly more opaque to X-rays than untreated wood. It is therefore suggested that the depth of impregnation be determined by passing X-rays axially through a sample cross-section of the pole. To avoid misleading shadows due to internal irregularities of the wooden structure, the author designed a special device wherein the wooden sample piece is slowly rotated around its axis while the X-ray exposure is being made on the photographic plate. The encouraging results which the author obtained in this way caused further research with X-rays, analysis of solid materials disclosing the possibility of determining the percentage of ash content in samples of coal and X-ray pictures also affording a means of checking the homogeneity of porcelain insulators.—*Elektrotechnische Zeitschrift*, April 8, 1926.

*Synchronous Condenser as Economical Voltage Regulator.*—E. SCHÖNHOLZER.—In the introduction of this 33-page paper the writer recommends European power systems to benefit by the good results obtained in American plants with the use of synchronous condensers as voltage regulators on long three-phase transmission lines. With the aid of exceptionally clear and large-scale vectorial diagrams the author develops curves from which at given station output and current cost the most economical transmission voltage may be determined. The potential is assumed to be regulated by synchronous condensers. The self-protection of such a system arising from the valve action of the corona and the simplicity of the power transformers, which require no voltage taps, are emphasized. Three concrete examples indicate the proper use of the author's graphical methods. These examples indicate that the connection of an idly running synchronous motor to the end of a long transmission line or to a feeder point on an overland bus is not only of great value from the operating standpoint, but may also be of considerable economical benefit.—*Bulletin de l'Association Suisse des Electriciens*, April, 1926.

## Units, Measurements and Instruments

*Meter Laboratory of the Berlin Municipal Works.*—P. MAY.—After a short historical review of the 40 years of existence of the main meter laboratories of the Berlin Municipal Electric Works, the author gives a description of their present fully up-to-date equipment. Every one of the meters installed at customers' premises is returned to the laboratory after three to four years to be checked and overhauled. About 900 meters are thus always on hand to be recalibrated. Meters of up to 4,000-amp. current and 6,000-volt potential can be handled. Two large storage batteries and several motor-generators provide the energy for 180 calibrating desks. Wiring diagrams are given to show the flexibility of the laboratory equipment. Of interest is an automatic-meter loading device which can adjust 2,000 different loads for a series of tested meters in definite time intervals of running and standstill.—*Elektrotechnische Zeitschrift*, April 22, 1926.

## Illumination

*Demonstration Method of Teaching Good Lighting Practice.*—G. S. MERRILL.—Attention is called to the importance of bringing the general level of lighting practice up to modern standards. In this connection the use of stationary and portable demonstration rooms is discussed. Examples are given of such equipment.—*Transactions I.E.S.*, April, 1926.

*Practical Illuminating Engineering.* A. L. POWELL.—The author divides the subject into four classes—educational work, investigations and compilations, experimental and development, and specific recommendations. Each of these is discussed.—*Transactions I. E. S.*, April, 1926.

*Further Experimental Data on the Predetermination of Daylight from Windows.*—H. H. HIGBIE and A. LEVIN.—A recent paper, noted in the Digest, contained a description of a rational method for predetermining daylight illumination from windows and presented the results of data from actual tests as a check. The present brief paper supplements those results by two others, one from measurements in a schoolroom, the other in a large

library. Starting with the average window brightness, from measurements at a number of equidistant points on the window, and computing the illumination to be expected along an axis of the room in accordance with the formula previously developed, it is shown that the curve of actual illumination agrees closely in form with the predicted, but gives somewhat higher values, especially toward the rear of the room. Since the computations do not take wall reflections into account, this difference is to be expected. The results demonstrate again that daylight illumination can be predicted on a rational basis.—*Transactions of I. E. S.*, April, 1926.

## Heat Applications and Material Handling

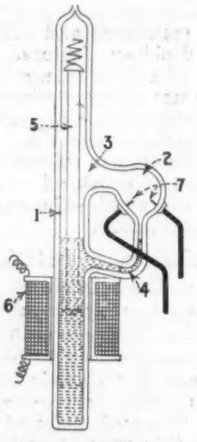
*Compressed-Air Grain Elevator.*—G. KRAPF.—To unload grain from Rhine River boats at Basel, Switzerland, in an economic and expeditious manner a new grain elevator of the pneumatic type has been installed on a large portal crane traveling along the river bank. The elevator has a capacity of 60 tons to 90 tons of grain per hour. A three-phase, 70-kw. motor drives over a gearing an 8,000-r.p.m., three-stage blower, which produces a suction of about 30-cm. mercury column. The blower is connected to a large separation chamber, from which two flexible suction pipes lead into the grain vessel. A small auxiliary blower separates the dust from the grain. The motor which operates this blower drives also a belt conveyor. This feeds the material to a vertical bucket conveyor, which in turn deposits the grain into a 40-ton hopper. To guard against excessive overload of the blower motor, such as may be occasioned by a withdrawal of the suction nozzle from the grain, a pressure-actuated switch is connected to the main suction pipe. In addition the motor is protected by an overload relay switch. — *Brown, Boveri Mitteilungen*, March, 1926.

*Alternating-Current Arc Welding.*—J. BETHENOD.—The striking of the arc in alternating-current arc welding represents a short circuit on the feeding transformer, which has to be alleviated either by high internal reactance of the transformer itself or by a series choke coil. Both of these means lower the average power factor of the welding eqiupment. A decided improvement in this respect has been achieved with the new welding method described in this paper. Parallel to the main arc transformers is a small auxiliary transformer. This energizes an oscilatory circuit, which is itself coupled to the arc circuit over a Tesla coil. The result is a high-frequency, high-voltage discharge which jumps the gap between the welding electrode and the piece of work before the two are brought into contact. The air ionization caused by this spark is sufficient to make the low-frequency arc follow the path. A contact placed in the electrode handle starts and interrupts the "pilot" spark. From tests made on commercial equipments of this type an average electric efficiency of 85 per cent and power factor of 60 were measured.—*Bulletin de la Société Alsacienne de Constructions Mécaniques*, April, 1926.

## Motors and Control

*Steam Versus Electrically Driven Rolling Mills.* — H. WENDT. — Reliable operating data on any rolling mill process are very difficult to obtain, because they depend to a large extent upon the skill of the machinist and the roller. This difficulty becomes still greater when a comparison is attempted between a steam and an electrically driven roll, operated by different crews. The author has attempted to eliminate the human element by constructing from a large number of individual rolling diagram records the best average diagram representing the rolling process of a given ingot into a certain final shape. This method was followed for steam operation and for electric drive with an Ilgner converter set. A large number of records are reproduced as curves and tabulations, showing distinct advantages for the electric drive. — *Zeitschrift des Vereines Deutscher Ingenieure*, May 1, 1926.

*Time Switch.*—E.. G. SANITAS.—A very inexpensive time switch without moving parts, serviceable for small house-lighting circuits, is described in this short article. Essentially the construction comprises a small solenoid, within which is a mercury-filled glass tube. In the mercury floats an iron core. When current circulates for a brief period through the solenoid the iron will be made to plunge into the mercury and a certain part of that liquid will be displaced, flowing into a communicating glass ball into which two platinum wires are sealed. This will establish a circuit. The glass ball communicates at its bottom with the main glass tube over a capillary tube, and it will take some time for the displaced mercury to flow back. The size of the capillary will determine the time element of the switch. — *Elektrotechnische Zeitschrift*, April 8, 1926.



SECTION THROUGH TIME SWITCH NOT ENERGIZED

## Electrophysics, Electrochemistry and Batteries

*Power Losses in Magnetic Sheet Material at High Flux Densities.*—C. E. WEBB.—From an examination of the results of a number of investigators, it is shown that while there is general agreement as to the validity of Steinmetz's expression $\pi B^x$, where $x$ is a constant index for the hysteresis loss and flux densities up to about 10,000 c.g.s. units, there are considerable divergences between the results of different experimenters and flux densities above that value, particularly on sheet material. In the paper a series of tests both by alternating current and ballistic methods on a wide range of sheet material are described. The results appear to confirm the increase in the exponent of $B$ in the expression for the hysteresis loss at values of $B$ between 10,000 and 15,000. The construction of a new Lloyd square for tests at still higher flux densities and a further, more detailed series of tests, both alternating-current and ballistic, on a representative specimen of each type of material, making use of this square, are then described. These tests are carried up to $B = 17{,}000$ or 18,000, and while confirming and extending the previous result of increased exponent for $B$ values up to 16,000, they indicate a rapid decrease in the exponent at the highest values of $B$ employed.—*Journal of Institution of Electrical Engineers, London*, April, 1926.

## Traction

*Regenerative Braking of Trolley Cars.*—W. BETHGE.—Exacting tests are described in this article which were undertaken to determine the braking effect of trolley cars when their motors are utilized as generators, discharging their energy into resistance grids. This type of electric braking is used extensively on European trolley lines. Within the running car were measured the speed of travel, the r.p.m. of the motors, the current absorbed by the motors and the deceleration, while an oscillograph installed on the ground near the test track measured and recorded the current generated by the motors when braking. The data obtained were used to plot curves showing the braking effect for various conditions, such as braking with one or both motors, gradual braking, emergency braking, braking on dry and wet rails, etc.—*A.E.G. Progress*, April, 1926.

## Miscellaneous

*Fodder Conservation.*—A. VIETZE.—Various methods have been suggested and actually used in past years whereby freshly cut fodder was conserved in silos by placing the contents of the silo between a bottom and top electrode and passing current through it. The satisfactory results achieved by these methods were ascribed to the bacteriocidal effect of electric current. According to the author's investigations, however, the electric current in all these methods plays only a secondary rôle. What actually does the conserving is the heat generated by the current in the semi-conducting fodder. A temperature rise of 50 deg. C. and a fairly airtight silo are all that is required. The author has developed a new conservation method whereby the fodder is stored in a well-made silo and, when the silo is full, a jet of hot air produced by a motor-driven fan and an electric heater in the air pipe is blown through the contents for six to twenty-four hours until internal thermometers register desired rise. A top layer of dirt provides upper seal against air.—*Der Elektrische Betrieb*, April 24, 1926.

# News of the Industry

## Layman Out of Wagner Corporation

### Retirement Follows a Seven-to-Six Vote Against Him in the Board of Directors—Operating Committee of Four Has Assumed Charge—Layman's Statement

GREAT interest was aroused in electric manufacturing circles on Friday of last week by the news that Waldo A. Layman had ceased to be president and chairman of the board of the Wagner Electric Corporation. His retirement was forced by the board of directors by a vote of seven to six. Mr. Layman himself announced the news immediately in a letter addressed to the district managers of the St. Louis company. In this letter he said:

"I desire to be the first to inform you that by a decision of seven to six the directors of the company have retired me from the organization. I attach a clipping from the St. Louis *Globe-Democrat* which will tell you about all the story there is to be told. I cannot attempt this morning to write you how I feel about the separation from the members of the working staff. I will try to do this early next week. In the meantime may I say that I feel a deep sense of personal relief in being 'fired'? At a meeting held yesterday afternoon the board selected an operating committee of four, consisting of Messrs. Timmerman as chairman, Postlethwaite, G. L. Evans and Bergenthal, with full power to continue the business, and you will hear from this committee further as occasion may make necessary."

The operating committee named in this letter is made up of two vice-presidents of the company—A. H. Timmerman and P. B. Postlethwaite—the general superintendent, G. L. Evans, and the treasurer, V. W. Bergenthal.

Mr. Layman's retirement is generally understood to be the culmination of five years' division and contest for control of the board as between the old interests and the new ones which came in with refinancing.

#### MR. LAYMAN'S STATEMENT

In the formal statement issued to the press to which Mr. Layman refers he said:

"It is true I am retiring from the presidency and active executive management of the Wagner Electric Corporation. I am not doing this voluntarily. I have had too much to do with the development of the property, have too great a pride in its history and confidence in its future and, incidentally, too large a financial interest to quit the fight for a complete restoration of the company's prosperity short of the goal. However, seven of the thirteen directors, as required by the bylaws of the company, have requested this action. It is represented to me by these directors that they were actuated in part by the wishes of dissatisfied stockholders and in part by the expectation that a change in the executive direction will get quicker and better results. No management of a corporation can succeed without the full confidence and enthusiastic support of the entire board of directors. So I am dropping out.

'The company is in sound condition and its stage is set, in my judgment, for surmounting all the difficulties of recent years. In some respects the internal conditions are exceptionally fine. The organization of some three thousand employees is as free from friction and controversy and the spirit

W. A. LAYMAN

of loyalty and co-operation as fine as any St. Louis institution ever experienced. Production efficiency is good and the employees are relatively happy and contented. The company's difficulties, which are crystallized in its failure to pay common-stock dividends in recent years, had their origin during the war, when heavy bank loans were contracted to finance unprofitable war contracts. Then followed post-war deflation losses, costly refinancing when money was high priced to pay off these bank loans, a greatly enlarged capital structure, necessitating the building up of correspondingly enlarged operations in order to hope to restore common-stock values, and six years of constantly declining sales prices on all the company's products in a market of unprecedented competition. We have been too big to shift quickly to profitable business in sufficient volume, although that shifting is in process, and too small to control non-competitive buying of our products. My own view is that I gave the corporation during the last six years the best management in its history, and my own best work of thirty-four years, under conditions of unprecedented economic difficulty, but recent financial statements have not disclosed this to the stockholders nor avoided disappointment to the directors.

"My withdrawal from the management will terminate a continuous active service with the corporation of about thirty-four years, this service beginning in 1892 as draftsman and testing engineer and continuing thereafter in the successive capacities of assistant superintendent, assistant manager, treasurer, manager, vice-president and president. During this interval the company has grown from an organization of twenty-two employees to its present dimensions. Since 1902 I have had executive direction of all of the operating departments of the business. At that time the company faced a crisis far more serious than any condition since prevailing. Liquidation of the business was in actual contemplation. We turned the tide in the company's affairs, and twenty prosperous years of the company's history followed."

#### MR. LAYMAN'S CAREER

Born at Smithton, Mo., in 1869, Mr. Layman's high-school education was gained in Terre Haute, where as a very young man he did newspaper work, simultaneously studying at the Rose Polytechnic Institute in the Indiana city, from which he was graduated with the degree of B.S. in 1892. In the fall of that year he entered the employ of the Wagner Electric Manufacturing Company in St. Louis as a utility man in testing and drafting work. With this company and its successor he has spent his whole business life, rising step by step until he became executive head, as general manager, in 1902. He was made first vice-president in 1908 and president in 1912, succeeding S. M. Dodd, who became chairman of the board, and on the death of Mr. Dodd a month later Mr. Layman assumed the chairmanship as well. For 24 years he was in full charge alike of the financial, engineering and manufacturing interests of the business, and his ability in all three lines of work has won wide recognition. As an engineer Mr. Layman made the original drawings of the first Wagner line transformers and direct-current motors thirty years ago, and he played a vital part in the development of the Wagner single-phase motor.

Under Mr. Layman's management, it is pointed out, the Fynn-Weichsel motors, "Lockhead" hydraulic brakes and fan motors have been added to the company's lines of output in the course of a program of building up its trade structure to balance its reorganized financial structure.

He is a fellow of the American Institute of Electrical Engineers, has

been a member of the executive committee of the National Electric Light Association, is past-president of the Engineers' Club of St. Louis and of the National Metal Trades Association and has been actively connected also with many other business, civic and social organizations.

## Still Sparring Over Shoals

**Senator Harrison Demands Action, but Steering Committee of Upper House Remains Non-Committal**

SENATOR HARRISON of Mississippi in remarks made on the floor of the Senate on Wednesday urged that Congress give up the idea of adjourning until the Muscle Shoals bill has been passed or defeated. He declared that Muscle Shoals has been before Congress since "time whereof the memory of man runneth not to the contrary" and urged that the steering committee give it a place on the legislative program now being formulated. The Mississippi Senator called attention to the fact that the Senate and the House of Representatives had agreed to refer the matter to a joint committee, which has made its report. "The committee's report is here," said Senator Harrison, "and if we are to put off action until December there will be no legislation respecting Muscle Shoals."

Senator Curtis, the majority leader, stated that the Muscle Shoals bill is among those receiving consideration by the steering committee. He explained, however, that it is impossible to foretell what action that committee may take. Senator McKellar of Tennessee introduced a resolution calling upon the joint committee to inform the Senate as to the ownership of the stock of the Muscle Shoals Fertilizer Company and the Muscle Shoals Power Distributing Company. He asks that the actual amounts of the stock owned by the thirteen associated Southern power companies be set forth. It happens that the joint committee already has in its possession most of the information sought by the resolution, but some further data are being submitted by the two companies.

## Issue of St. Lawrence License by New York in Doubt

Notwithstanding seemingly inspired newspaper reports that political pressure from high quarters had been brought to bear upon the New York State Water Power Commission to defer the issuance of any license to develop power on the St. Lawrence River until after the elections next fall, Attorney-General Ottinger, the chairman of the commission and an avowed advocate of private development, admonished the American Super-Power Corporation on Thursday, at a meeting of the state body, to get all its data in at once as the commission intended to act quickly on the applications before it.

An entire change of front on the part of the American Super-Power Corporation was evidenced when G. W. Saathoff, its chief engineer, declared that from an engineering standpoint a single-stage development is feasible and preferable. The engineering report, based on five years of study, was compiled in a month's time by forty engineers and embodies four alternative plans, ranging in estimated cost from $207,000,000 to $235,000,000 and from $82.10 to $120 for cost per horsepower of installed capacity. This does not include the cost of navigation, which would entail an additional outlay of more than $50,000,000.

Plan No. 3, calling for a single-stage development with 85-ft. head at Barnhart Island, much like the plan proposed by the Frontier Corporation, is the plan favored by the applicant.

## Jobbers at Hot Springs

**All Parts of the Country Are Well Represented at the Annual Summer Convention**

THE eighteenth annual summer convention of the Electrical Supply Jobbers' Association was held this week at Hot Springs, Va., with a larger attendance than for several years, including representatives from all over the country, with an unusually large delegation from the Pacific Coast. Monday and Tuesday were devoted to executive and merchandising committee meetings with general sessions. Wednesday to Friday three principal speakers addressed the general sessions.

Edwin W. Ely of the United States Department of Commerce spoke on the subject of simplification, pointing out the economic benefits to be derived from further eliminations of excess and duplicate varieties of manufactured products throughout the course of distribution. S. J. Ryan, consulting editor of *Electrical Merchandising*, spoke on modern tendencies in the retail merchandising of electrical supplies, urging the jobber to take more active measures to guide and retain the distributing function in domestic electrical appliance lines. He pointed out from the experience of the department store some of the fundamentals of retailing to the home. Charles Nash of the Standard Sanitary Manufacturing Company talked on distributing practices in the wholesale plumbing supply industry.

The following officers were elected for the coming year: Atlantic Division—Chairman, W. I. Bickford, Pittsburgh; representative Southern District, H. R. Worthington, Jacksonville; representative Pittsburgh District, E. M. Keatley, Charleston, W. Va. Central Division—Chairman, H. C. Downey, Des Moines; representative Chicago District, W. W. Low, Chicago; representative Missouri River District, G. W. Johnson, Omaha.

The next meeting of the association will be held in Atlantic City at the Hotel Traymore in the week of Oct. 18, instead of in Cleveland or Buffalo as has been customary. The change has been made to give the members and guests an opportunity to attend the Sesqui-Centennial Exposition in Philadelphia. An invitation was extended by the delegates from the Pacific Coast to hold the next summer convention at Del Monte, Cal., but action on the invitation was deferred until October.

## High Heads in California

**State Sees Simultaneous Erection of Noteworthy Plants on Kings and Feather Rivers**

ANTICIPATORY news of the two hydro-electric plants to be built respectively on the Kings and the Feather River in California, both of which will be notable for their high heads, was published in various issues of the ELECTRICAL WORLD for 1925. This year is seeing work going on simultaneously on the two plants.

For the Kings River plant the San Joaquin Light & Power Corporation, now a subsidiary of the North American Company, has obtained final permits from the state, covering the river and its tributaries in California. This project is to take form on the west slope of the Sierra Nevadas, in the heart of the agricultural region. Parts of it have already been constructed. The Balch power house, the first to be built, will contain an initial unit rated at 28,250 kw., to which five similar units are to be added. The contemplated ultimate development on the Kings is 500,000 hp. and will include nine power houses and fourteen dams. There will be a total distance of 7,290 ft. between the highest water reservoir and the lowest power house. The Balch station will utilize a static head of 2,381 ft. The high-voltage transmission line to connect the San Joaquin system with that of the Great Western Power Company—also now a North American subsidiary—will, according to an official statement, be in operation soon.

At the Bucks Creek plant, in Plumas County, now under construction by the Feather River Power Company, the difference in height between the average forebay level and the waterwheel nozzles will be 2,552 ft. An unusual feature of this project to which attention has recently been called will be the ratio of storage capacity to yield. At the main Buck Creek reservoir there is an estimated annual run-off from the watersheds above the dam of 72,000 acre-ft. In order to control this run-off a storage capacity of 103,000 acre-ft. will be provided. The average total yield through the power house will be 114,000 acre-ft. per year, and this will produce 205,000,000 kw.

The dam to form the storage basin will be constructed in the wide mouth of Bucks Meadows. It will be 1,220 ft. long on the top, will rise 118 ft. above the stream bed and will be of the rock-fill type. The power for the initial 50,000-kw. installation will be generated by two General Electric 25,000-kw., 11,000-volt waterwheel-driven generators. It is planned eventually to add three major and three minor plants, bringing a total ultimate rating of around 300,000 hp.

The Great Western Power Company, whose transmission lines extend into the neighborhood, is under contract to buy all the power generated at the Feather River plant, and the plant will become its property at the end of 35 years. Excepting the Pike's Peak plant at Colorado Springs, Col., no other hydro-electric development in America has a head as high as the Feather River and Kings River plants will have.

## A Luminous "Liberty Bell"

**Spectacular Feature of Sesqui-Centennial Can Be Seen 50 Miles from Philadelphia**

WITH the opening of the Sesqui-Centennial Exposition at Philadelphia on Memorial Day one of the most notable examples of spectacular illumination yet seen came into being. This was the "Liberty Bell" at the entrance to the grounds, designed by D. W. Atwater of the Westinghouse Lamp Company and erected under the supervision of L. T. Darrin, electrical engineer-in-chief of the Sesqui-Centennial. Reaching 80 ft. above the sidewalk, the replica of the historic bell contains more than 26,000 15-watt lamps in amber, ivory and rose colorings. The structure contains 80 tons of steel and rests on a foundation 30 ft. deep built of wooden piling and concrete capping.

When lighted the bell is visible the entire length of Broad Street and from every vantage point in Philadelphia. Its light will be seen for 50 miles in every direction. The columns on which the support of the bell rests were designed by Wiard B. Ihnen and represent American industry and progress. They are made of plaster and painted a bronze metallic color to blend with the predominating golden amber hue of the luminous bell.

This bell, however, while the main feature of the Sesqui-Centennial lighting, is only one of the many unusual illumination spectacles as a result of which the exposition will far outshine any previous affair of its kind. The Philadelphia City Hall has been transformed by a lighting scheme in tones of red, blue and deep purple. Eight hundred and sixty immense floodlamps with color screens are used to paint the city's headquarters with light, 40 tons of electric cable being used for the wiring. The famous statue of William Penn on the apex of the tower is lighted by four 1,500,000-cp. searchlamps, and eight beacons shine radially through the portholes below the statue.

There is to be, besides, a "tower of light," stretching far above the other exposition buildings. This tower will, when illuminated at night, be visible from all parts of the city as a lofty silver shaft. It will be 200 ft. high and will be erected between the two main exposition buildings, in the center of the grounds. A 62-in. Sperry searchlamp, the largest ever built, will be mounted on top of the tower and will be used to sweep the exposition grounds and prominent buildings in Philadelphia.

Twenty-four searchlamps with a combined intensity of 10,800,000,000 cp. are being installed at the Sesqui-Centennial site and will, it is said, provide the greatest concentration of light ever seen. These searchlamps will be placed at intervals along both sides of the grounds and will be used with color screens to form fantastic light effects. One of the many unique searchlight effects will be an immense colored aurora visible as far away as New York, many miles at sea and far inland.

Ornamental standards and floodlamps are being used to illuminate the "Grand Court" and produce an effect never before attempted. The towers of the exhibition palaces are brought out in a blaze of color and contrast. The "Gladway," which adjoins the "Grand Court" on the west, is illuminated by myriads of lights of various magnitudes. The lagoons will be swept by varicolored floods of light. Independence Hall, in downtown Philadelphia, has been floodlighted in pure white light, as it was judged more fitting to keep the appearance of this historic shrine unchanged.

## Western Engineers Elect Honorary Members

An absence of technical discussions was the distinguishing mark of the fifty-sixth annual meeting of the Western Society of Engineers, held at 6 p.m. on June 2 at the Palmer House for a reception and dinner. President Homer E. Niesz presided, and the ceremonies included the bestowal of honorary membership on Secretary of Commerce Hoover, Samuel Insull and Ralph Modjeski, the designer of the new Delaware River bridge between Philadelphia and Camden. The 1926 Washington award, administered by a commission representing the Western Society of Engineers and the four founder societies, for pre-eminent services in promoting the public welfare was bestowed upon John Watson Alvord for "his pioneer work in developing the fundamental principles of public utility valuation and his marked contributions to sanitary science."

F. E. Morrow, president-elect of the society, addressed the banqueters. Other new officers are Major Rufus W. Putnam, first vice-president; John A. Garcia, second vice-president and M. M. Fowler, third vice-president.

## Transmission Problems Analyzed

**Niagara Falls A.I.E.E. Meeting Listens to Profitable Discussion of Line Disturbances—Other Sessions Cover Wide Range of Technical Subjects**

THE meeting of the Northeastern District of the American Institute of Electrical Engineers at Niagara Falls on Friday afternoon, May 28, was devoted to power transmission, and the papers presented and the discussion covered American and foreign practices and experience with high-voltage lines. The feature of the meeting, of which P. H. Thomas was chairman, was the paper by M. L. Sindeband and P. S. Sporn in which they discussed operating difficulties due to lightning and other causes and changes in design and insulation to correct failures on a 132-kv. steel-tower transmission line. Their experience indicated the importance of a ground wire for protection against flashovers, but they particularly emphasized the necessity of correct installation. The chief subject of the discussion which followed was the need of a ground wire, with opinion generally in favor of it. F. W. Peek, A. O. Austin, C. F. Scott, V. Karapetoff and A. E. Knowlton were some of those who participated in the discussion.

S. Q. Hayes outlined the increasing size and importance of the transmission interconnections now being made not only in this country but in Europe, Australia and Japan. Robert Treat, in a short discussion, urged the vital need of continuity and quality of service being insured to the customers if such interconnections are to be successful.

L. E. Imlay read a paper prepared by G. F. Chellis describing transmission and distribution practice in England, Switzerland, France, Italy, Germany and Spain. A set of formulas in the form of a convergent series, eliminating trial and error methods, was given by H. B. Dwight in his paper on "Sag Calculations for Transmission Lines." Theodore Varney's paper on "Vibration of Transmission-Line Conductors" described tests made in the field with a graphic recorder to show the vibration of the conductors under various conditions of wind velocity, conductor tension and span length.

Two papers on mercury-arc rectifiers were presented at a previous session, on Thursday morning. One by O. K. Marti, was a condensed account of the theory of the rectifier and a description of a modern European type. D. C. Prince dealt with rectifier voltage control by means of a saturated-core interphase transformer. The discussion which followed brought out differences in American and European practice and showed the progress made in both continents.

Other papers presented at this session, of which J. A. Johnson was chairman, were: "Polarization of Radio Waves," by E. F. W. Alexanderson; a description of a new nickel-iron for use as a core for current transformers, by Thomas Spooner; "Calibration of Lichtenberg Figures," by K. B. McEachron; "A Flux Voltmeter for Magnetic Tests," by G. Camilli, and "Circulation of Harmonics in Transformer Circuits," by T. C. Lennox.

H. C. Don Carlos was chairman of the Friday morning session, which dealt chiefly with power-station and substation equipment. V. Karapetoff first presented a paper on the variable armature leakage reactance in salient-pole synchronous machines. J. A. Johnson and E. J. Burnham then described a new method devised for fire protection in the generators installed at Niagara Falls. As far as known this is the first scheme devised using a fusible link and special type of sprinkler heads. Tests on a dummy model were described and the way in which the fire was localized in a small area was illustrated.

F. V. Smith described the application and operation of automatic equipment and supervisory control in a number of hydro-electric plants of various capacities. W. H. Gerrie, C. F. Publow and A. G. Darling outlined some of the difficulties found and the remedies being used in this type of equipment on the system of the Hydro-Electric Power Commission of Ontario.

J. A. Johnson presented the last paper of the session, which dealt with the retardation method of loss determination

as applied to the 65,000-kva. generators at Niagara Falls.

The convention banquet, Thursday evening, was presided over by H. B. Smith, the retiring district vice-president. Edward Dean Adams, veteran promoter of Niagara development, made the principal address, recounting the early history of the movement. C. C. Chesney, newly elected president of the A.I.E.E.; H. M. Hobart, newly elected district vice-president; Paul Schoellkopf, G. Faccioli, F. L. Hutchinson, C. F. Scott and L. T. Robinson also made short talks, the latter including demonstrations of the latest methods of reproducing sounds.

The Institute prize for the best paper of the year was awarded to K. B. McEachron and E. J. Wade, and the prize for the best first paper was divided between C. A. Nickle and R. W. Wieseman.

## Radio Legislation Still in Abeyance

No place on the legislative program had been assigned to radio at the time of this writing. Senator Dill, who is in charge of the bill reported from committee, is, however, prepared to fight for an opportunity to consider the legislation if the leaders will not accede to his request for time. But even if the bill is brought before the Senate it is very doubtful whether it can be brought to a vote. The White bill, which leaves control of broadcasting with the Secretary of Commerce instead of vesting it in a new commission as the Dill measure does, has many friends in the Senate, although some of them believe it would be better to get the Dill bill on the statute books rather than to have no legislation. They point out that the law can be amended at any time that the votes can be obtained. In fact, some think it will be easier to amend the law than to amend the bill, as the weak spots in the Dill measure soon will become more glaring when an attempt is made to put those provisions into effect.

At the White House it was stated that there is no justification for the publication of the statement that the President, despite his preference for departmental over commission control, will veto the Dill bill if it should pass. It is certain that many of the features of the White bill would have to be embodied in the Dill bill before the House would accept the conference report. For that reason the President apparently will wait the final form of the legislation before making up his mind as to the action he will take.

Before the bill can pass it will be necessary for the Senate to vote down a series of amendments which have been prepared by the so-called radical group of Senators. They want all stations put on a public utility basis and would take away from the management various rights in connection with the control of who may speak and what may be said.

## Indiana Electric Light Association Meets

A large registration was recorded at a joint meeting of the Indiana Public Utility Association, the Indiana Electric Light Association and the Indiana Gas Association which was held at West Baden, Ind., this week, beginning on Wednesday. The Electric Light Association had a separate session on the first day, under the chairmanship of L. B. Andrus, at which R. F. Schuchardt of Chicago, chairman of the power survey committee of the Great Lakes Division, N.E.L.A., discussed Indiana's place in the electric power field. In the evening, before the united associations, Robert G. Gordon spoke on the Muscle Shoals development, showing what it means to the public industry and the general public.

## Now for Annual Meeting

### Promising Program for Convention of Institute at White Sulphur Springs Is Ready

CLOSELY following the regional meeting of the American Institute of Electrical Engineers at Niagara Falls, the annual convention, to be held on June 21-25 inclusive at The Greenbrier, White Sulphur Springs, W. Va., will have a still wider appeal. The varied program of technical papers and reports, which in its tentative form is printed herewith, will include as subjects the theory of synchronous machines, non-harmonic alternating currents, alternating-current circuits, dielectric breakdowns, rectifiers, magnetization, heat transfer in machines, auto-transformers, electrical measurement of mechanical vibrations, remotely controlled substations, high-speed circuit breakers, regenerative braking and windings for direct-current machines. These proceedings will fill six morning sessions, parallel sessions being twice resorted to, and the afternoons will thus be left free for recreation. This the resort affords in abundance by the provision of tennis courts, golf links, a swimming pool and other facilities.

The only evening meeting, apart from a reception and dance on Tuesday evening, will be on Wednesday, when the work of the International Electrotechnical Commission, the American Engineering Council and the American Engineering Standards Committee will be explained respectively by the president of the United States National Committee of the I. E. C., the executive secretary of the A. E. C. and the chairman of the A. E. S. C.

The next Institute gathering after that at White Sulphur Springs will be the Pacific Coast convention at Salt Lake City on Sept. 7-10. Another regional meeting will be held in New York City, starting Nov. 11.

## Tentative Program of Annual Convention of A.I.E.E.

WHITE SULPHUR SPRINGS, W. VA., JUNE 21-25

**Monday, June 21**

Conference of section delegates under auspices of the sections committee, morning and afternoon.

**Tuesday, June 22**

*Morning.*—President's address, M. I. Pupin.

Award of A.I.E.E. prizes for papers.

Technical committee reports:

Research, J. B. Whitehead.
Electrophysics, J. H. Morecroft.
Education, Harold Pender.
Standards, H. S. Osborn.
Instruments and measurements, A. E. Knowlton.
Communication, H. P. Charlesworth.
Production and application of Light, P. S. Millar.
Electrical machinery, H. M. Hobart.

**Wednesday, June 23**

*Morning.*—Session A:

"Synchronous Machines (Extension and Interpretation of Blondel's Treatment)," R. E. Doherty and C. A. Nickle, both of General Electric Company.

"Non-Harmonic Alternating Currents," Frederick Bedell, Cornell University.

"Graphical Solution of Alternating-Current Circuits," F. W. Lee, Johns Hopkins University.

Session B:

"Remotely Controlled Substations," W. C. Blackwood, New York & Queens Electric Light & Power Company.

"The High-Speed Circuit Breaker in Railway Feeder Networks," J. W. McNairy, General Electric Company.

"Regenerative Braking for Direct-Current Locomotives," Alfred Bredenberg, Jr., General Electric Company.

"Multiplex Windings for Direct-Current Machines," C. C. Nelson, Massachusetts Institute of Technology.

*Evening.*—Addresses:

"International Electrotechnical Commission," Clayton H. Sharp.

"American Engineering Council," L. W. Wallace.

"American Engineering Standards Committee," C. E. Skinner.

**Thursday, June 24**

*Morning.*—Technical committee reports:

Power generation, V. E. Alden.
Power transmission and distribution, P. H. Thomas.
Protective devices, E. C. Stone.
General power applications, A. M. MacCutcheon.
Applications to iron and steel production, F. B. Crosby.
Applications to mining work, F. L. Stone.
Applications to marine work, L. C. Brooks.
Transportation, C. T. Hutchinson.
Electrochemistry and electrometallurgy, G. W. Vinal.

**Friday, June 25**

*Morning.*—Session A:

"The Mechanism of Breakdown of Dielectrics," P. L. Hoover, Harvard University.

"Mercury-Arc Rectifiers," D. C. Prince, General Electric Company.

"Electrical Recording of Vibrations," A. V. Mershon, General Electric Company.

Session B:

"Law of Magnetization," S. L. Gokhale, General Electric Company.

"Surface Heat Transfer in Electric Machines with Forced Air Flow," G. E. Luke, Westinghouse Electric & Manufacturing Company.

"General Theory of the Auto-Transformer," W. L. Upson, Washington University.

## Purchases and Mergers

**Municipal Plants Figure Prominently in Transactions of Week—No Outstanding Sale**

NEW HAMPSHIRE'S Public Service Commission has approved the purchase of the Pittsfield Electric, the Bradford Electric and the Bristol Electric companies by the New Hampshire Power Company and will permit an issue of securities to the amount of $140,000 to pay for the acquired properties.

Application has been made to the New York Public Service Commission for consent to the purchase by the Wayland Light & Power Company of the stock of the Wayland-Steuben Power Company and to the merger of the two companies. The companies are owned by the same interests. The Wayland-Steuben company has been generating and purchasing energy and selling it wholesale to the other company.

All the capital stock of the Oswego River Power Corporation, which in March purchased the People's Gas & Electric Company of Oswego, N. Y., has been absorbed by the Northeastern Power Corporation, including a substantial interest previously owned by the Niagara, Lockport & Ontario Power Company. The Northeastern now owns developed and undeveloped water-power sites on eight rivers in the northern part of New York State, rated at 510,000 hp., of which 204,000 hp. is developed.

The Southern Colorado Power Company of Pueblo, a Byllesby property, has purchased the Arkansas Valley Electric Company, serving Florence, Coal Creek, Rockville and Williamsburg. The Southern Colorado had been selling electricity to the Valley company for some years.

A merger of the East Ohio Power & Light Company of Youngstown, Ohio, with the Pennsylvania-Ohio Power & Light Company has been effected. Both companies are controlled by the Penn-Ohio Edison Company, which is in turn a subsidiary of the Republic Railway & Light Company, Jersey City. The East Ohio has purchased its energy from the Pennsylvania-Ohio for distribution in Leetonia and Lisbon.

The New Jersey Gas & Electric Company, owned by A. E. Fitkin & Company, has purchased the municipal electric plants at Atlantic Highlands and Barnegat, N. J.

An offer has been made to the City Council of Bardstown, Ky., by the Union-Edison Company, at Chicago, to purchase the municipal water, light and power plant at Bardstown, at a price of $133,000. The company named recently purchased the plants at Bloomfield, Taylorsville and Lebanon Junction, and it is said to intend to make Bardstown the central point of distribution if the plant there is acquired.

A tentative agreement has been reached between the Wisconsin Power & Light Company and the Milton water, light and power system for the purchase of the latter's properties for approximately $40,000. The agreement is subject to a referendum election. The plant was taken over by the town last January from the McGowan Water, Light & Power Company.

The Nebraska Electric Power Company has offered to purchase the municipal lighting plant at Gordon, Neb., for $73,000. The voters will pass on the matter at a special election June 15.

The Appalachian Power Company has offered the city of Danville, Va., $2,500,000 for its electric power and lighting plant. The proposal is now before the Danville City Council, which is expected to act upon it quickly.

Lone Wolf, Okla., voted last week, 138 to 1, to sell its municipal electric plant to the Southwestern Light & Power Company and to give the company a franchise.

The Lyons (Ga.) municipal electric light plant has been sold to the Middle Georgia Power Company, the City Council having voted to accept the company's offer for the plant.

Four additional municipal lighting plants have recently been acquired by the Georgia Southern Power Company, a subsidiary of the Interstate Utilities Corporation, with headquarters at Dublin, Ga. These plants are in Claxton, Midville, Lyons and Wadley.

## Washington Studies Coal Situation

**Reaction of British Depression on United States—Important Part Played by Fuel Economy in Electric Plants and by Growth of Hydro Systems**

THAT the serious depression which underlies the British coal industry is reflected in the United States and in other coal-producing countries is apparent from studies being made in Washington of its far-reaching effects. There is enough competition between coal produced in the several countries of the world to influence the price level in each country, and the following analysis of the situation made by the Washington representative of the ELECTRICAL WORLD contains much of interest to electrical men.

To find the key to this world situation it has been necessary to examine the broad features of supply and demand of coal in the world market. In comparing present conditions with those existing in 1913—the last year before the war—two great tendencies are clear. One is the worldwide interest in fuel economy, which has tended to reduce the demand. The other is the competition of other sources of heat and power.

It has been found difficult to reduce to figures the effects of fuel economy. It is known, however, that the high prices and the shortages of war turned the attention of engineers to fuel economy in a much more determined way than ever before. This was particularly true among the electric utilities. It became the great test of operating efficiency. The route to rapid promotion for the aspiring engineer was through the boiler room.

Out of this movement there are certain places where the savings in fuel can be reduced to figures. In the United States the consumption of locomotive fuel in the freight service has decreased 18 per cent per unit of work done. In the passenger service the decrease has been 13 per cent. All of this has taken place since the war.

Improvements in blast-furnace operation and in coking practice have cut by 9 per cent the consumption of coke and coal per ton of pig iron. The savings of gas and tar and other by-products of present coking methods have reduced the consumption of heat by metallurgical industries by an additional 10 per cent. The electrical utilities have shown even a greater decrease. The pounds of coal per kilowatt-hour have been reduced 34 per cent since the war. Figures from Great Britain are hard to get, but those available show the same trend.

At the same time that fuel economy has been reducing the demand, other competitors of coal have been taking away a part of the market. Before the war the world demands of coal increased with surprising regularity at the rate of about 40,000 tons per year. Since the war there have been only three years in which the 1913 output was reached. The production in 1925 was 1,368,000,000 tons, which shows an apparent increase over 1913, when production was 1,342,000,000 tons. Most of the 1925 increase, however, came from German lignite. The world pro-

## Inventors Meet at N.E.L.A. Manufacturers' Exhibit

WHEN Thomas A. Edison was in attendance at the National Electric Light Association convention in Atlantic City two weeks ago he posed for his photograph with Dr. Lee de Forest, whose talking motion picture the two inventors had just seen used as an instructive unit to show the operation of the Servel electric refrigerator, voice and picture being heard and seen in complete synchronization. Mrs. Edison stands between the inventors.

duction of bituminous coal alone since the war never has reached the 1913 level. On a B.t.u. basis the world output for 1925 was not quite equal to that of 1913.

While the demand for coal has stopped growing, the production of its competitors has increased at a faster rate than before 1913. Water power has doubled since 1913, and the production of petroleum has much more than doubled. The increase in water power since 1913 is equivalent to 66,000,000 tons of coal per year. The increase in oil and gas is equivalent to 172,000,000 tons per year.

Putting it in another way, the contribution of coal and of its competitors to the world's supply of energy may be expressed as follows:

| | Percentage | |
|---|---|---|
| | 1913 | 1925 |
| Coal | 89 | 76 |
| Oil and gas | 7 | 16 |
| Water power | 4 | 8 |
| Total | 100 | 100 |

Before the war coal absolutely dominated the world's energy supply. It now supplies 76 per cent of that demand. This arrested growth has been all the more difficult for that industry because it had accustomed itself to a steadily expanding market. Even the British industry was growing. Coal production in Germany and in the United States was expanding very rapidly, while in some of the outlying new countries, of which South Africa is an example, the rate of growth surpassed that of the United States. The industry not only was accustomed to an increase in demand, but capacity has continued to increase even though the demand has not. In the United States this increase in capacity has been enormous. The same is true in the outlying countries, when expressed in percentage and not in tons.

The plight of coal is world-wide. For that reason the solution being worked out in Great Britain is being followed very carefully by the government's coal specialists in Washington. There seems little likelihood in the near future of any increase in cost per ton of bituminous fuel to electric light and power companies generating electricity by means of steam.

## New England Council to Deal with Power

The next quarterly meeting of the New England Council, representing many agricultural, industrial and commercial organizations in the six New England states, will be held on Friday, June 11, at Burlington, Vt. One of the subjects announced for consideration is power, the objectives adopted by the council being thus stated: (1) The most economical distribution of power throughout New England at the lowest possible rates consistent with good service; (2) maximum utilization of all water powers and interconnections for economy and protection of all interests; (3) reasonable regulation that will adequately protect the public interest and permit and encourage the healthy growth of the industry.

# Briefer News

**Bureau of Standards Asks New Plant.**—A new fireproof power plant for the Bureau of Standards to cost not more than $200,000 has been recommended by a Senate committee. The plant will eliminate duplication of equipment and will assure adequate power for testing and research.

**A "White Way" Along the Ute Pass.**—Thomas Cusack of Denver is to furnish right-of-way and advance the cost of a "white way" along the Ute Pass leading out of Manitou, Col., to Cascade and the Green Mountain Falls, power to be purchased from the municipal plant at Colorado Springs and the line to become eventually the city's property.

**A. S. T. M. Meets June 21-25.**—The annual meeting of the American Society for Testing Materials, to be held at Chalfonte-Haddon Hall, Atlantic City, N. J., June 21-25, will be divided into thirteen sessions, some being held in parallel. The committee on electrical insulating materials, of which F. M. Farmer is chairman, will present its report at the ninth session on the evening of Thursday, June 24.

### Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Association of Iron and Steel Electrical Engineers—Hotel Sherman, Chicago, June 7-10. John F. Kelly, Empire Bldg., Pittsburgh, Pa.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 7-11. F. Nicholas, 30 East 42d St., New York.

North Central Division, N.E.L.A.—St. Paul Hotel, St. Paul, June 8-10. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Pacific Coast Division, N.E.L.A.—Biltmore Hotel, Los Angeles, June 8-11. S. H. Taylor, 447 Sutter St., San Francisco.

Northwest Division, N.E.L.A. — Spokane, Wash., June 14-17. L. A. Lewis, Washington Water Power Co., Spokane.

American Association of Engineers—Philadelphia. June 14-19. M. E. McIver, 63 East Adams St., Chicago.

Georgia Electrical Association—Columbus, Ga., June 15, 16. W. W. Barr, 25 Houston St., Atlanta.

Society for the Promotion of Engineering Education — Iowa City, Iowa, June 16-18. F. L. Bishop, University of Pittsburgh, Pittsburgh.

American Institute of Electrical Engineers—White Sulphur Springs, W. Va., June 21-25. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, June 21-25. C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

National Council of Lighting Fixture Manufacturers—Montreal, June 23-26. H. B. Garrett, 424 Guarantee Title Bldg., Cleveland.

American Society of Agricultural Engineers—Lake Tahoe, Cal., June 23-26.

Michigan Electric Light Association—Mackinaw Island, June 24-26. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

American Society of Mechanical Engineers—San Francisco, June 28-July 1. C. W. Rice, 29 West 39th St., New York.

East Central Division, N. E. L. A.—Cedar Point, Ohio, July 13-17. D. L. Gaskill, Greenville, Ohio.

**Chicago to Install 5,872 New Street Lamps.**—Completion of plans for the purchase and installation of 5,872 new electric street lamps, authorized by a recently approved bond issue for $2,000,000, was announced last week by John T. Miller, commissioner of gas and electricity. The new lamps will provide illumination for approximately 200 lineal miles of streets. The West Side will get 2,439, the South Side 2,318 and the North Side 1,115. The new lamps will be rated at 250 cp. to 400 cp.

**Canadian Parliamentary Committee Approves Passamaquoddy Bill with Amendments.**—The bill authorizing the Canadian Dexter P. Cooper Company to harness the tides of Passamaquoddy Bay in the Maine-New Brunswick region for the development of electric power passed the private bills committee of the Canadian House of Commons on May 27 with a number of amendments. One of these provides that before the company can operate allocation of power between the United States and Canada, as determined by the International Waterways Commission, must be approved by the Dominion government. Another amendment provides that the majority of the directors must be British subjects. The company is not authorized to issue bonds in excess of $10,000,000.

**Army Aid for Cable Laying.**—The Secretary of War has authorized the use of the cableship *Dellwood* for laying two submarine light and power cables for the Puget Sound Power & Light Company from Richmond Beach to President Point in Puget Sound. The company asked the co-operation of the War Department since there were no commercially owned cableships available for the work. The new cable will supply light and power to the government Navy Yard at Bremerton, Keyport station, army forts on the Olympic peninsula and such cities as Bremerton, Port Townsend and Port Angeles. The work will be done at no expense to the government, and the Chief Signal Officer has been directed to render any assistance that may be needed.

**Hydro-Electrical Development in Germany.**—Some further particulars of the superpower station which is to be established on the Rhine at Niederschworstadt were given by the president of the Rheinfelden Electric Power Transmission Company at a recent meeting at Sackingen. The power station will be on the Baden side of the river and the dam and navigable locks on the Swiss side. The concession is to run for 83 years, and it is expected that the power available will amount to a minimum of 50,000 hp. and a maximum of 100,000 hp., which is to be equally distributed between the German State of Baden and Switzerland. The plant in the power station will comprise five turbines and alternators, each of 22,000 hp. The estimated cost of the complete installation is $12,000,000 as against a pre-war estimate of $7,000,000.

**A. E. C. Starts Safety Investigation.**—Active work has been started on the American Engineering Council's study concerning the relationship of safety and production. The work is being directed by A. W. Berresford, the executive vice-president of the Nizer Corporation of Detroit. The study is to cover ten basic industries, of which electric utilities are one. An engineer will be stationed in each of sixteen industrial centers in the East, Middle West and Southeast, and the work will be conducted under the supervision of a local advisory committee drawn from the sections of the national engineering societies, other engineering bodies and the local safety councils. The field work is to be completed by Sept. 1. Data will be gathered from about two thousand plants.

**Johns Hopkins Falls in Line with Meter Course.**—Establishment of a course in meter testing at Johns Hopkins University was announced last week by the Maryland Utilities Association. The course, which will be conducted from June 1 to June 13, is sponsored by the association and the Public Service Commission, and electric utility employees from Maryland, Pennsylvania and Virginia are expected to attend. Dr. W. B. Kouwenhoven, associate professor of electrical engineering at the university, will conduct the course.

**Ohio Has a Million Electrical Customers.**—A compilation of electric light and power customers in Ohio just made by the Committee of Public Utility Information in that state puts the total at 1,085,886, an increase of 95,055 in twelve months. Eleven companies supply 84 per cent of the total customers, the highest three being: Cleveland Electric Illuminating Company, 251,497; Union Gas & Electric Company of Cincinnati, 129,600, and Ohio Power Company, 108,156. The total investment of the industry in the state is put at $413,681,658.

**Power to Be Generated at Coolidge Dam on Gila River.**—Bids for the construction of the Coolidge Dam on the San Carlos Indian irrigation project in Arizona will soon be advertised for by the Department of the Interior, engineers having given their final approval to the plans. This dam, which will be built across the Gila River, will be of the type known as "multiple dome" and will cost approximately three million dollars. The engineers' report calls special attention to the fact that the construction of the dam and its use as a storage reservoir for irrigation will permit the generation of electrical power which will find an established market at profitable rates.

**Oklahoma's Big Hydro Project Takes New Form.**—J. F. Robinson, Oklahoma mine owner and operator, has filed an application with the State Drainage and Reclamation Commission for permission to construct four dams on the Grand River in Mayes, Wagoner and Cherokee Counties. He proposes, if the permit is granted, to have the project completed within five years and to supply the northeastern part of Oklahoma with electricity through hydro-electric power plants. A total of 247,000 hp. may be realized, the application says, and the estimated cost is put at $24,000,000. It is reported that the temporary permit to harness the Grand River in Oklahoma for power purposes which was granted the Grand River Hydro-Electric Company several months ago (see ELECTRICAL WORLD for Nov. 28, 1925, page 1123) is to be withdrawn in favor of the Robinson project. No water is to be used for irrigation purposes.

**Tennessee Electric Institutes "Motion-Picture Party."**—As the result of a peripatetic "visugraphic motion-picture party" which, by means of equipment contained in a big touring van, has been filming the development of hydro-electric power in Tennessee, showing also the application of electricity to industry and photographing the scenery, mines, factories and public institutions of the state, the Tennessee Electric Power Company is preparing entertainment and instruction for its customers and other Tennesseeans. The pictures will be shown widely in the

state. They will include the Ocoee River, Hales Bar and Great Falls plants and the load-dispatching system at Cleveland, as well as many views of Chattanooga and Nashville.

**Endowment Committee for Engineering Societies' Library.**—The United Engineering Society, in response to a request from the Engineering Foundation and repeated suggestions from the founder societies of civil, mining, mechanical and electrical engineers, has appointed an endowment committee to seek increased funds for the Engineering Foundation and Engineering Societies' library. W. L. Saunders, president United Engineering Society, is chairman, and L. B. Stillwell, chairman Engineering Foundation, and Sydney H. Ball, chairman library board, are members ex officio. Calvert Townley, H. A. Lardner and E. W. Rice, Jr., represent the American Institute of Electrical Engineers. Among other members of the committee are J. W. Lieb, Charles F. Rand and H. Hobart Porter. No "drive" is planned, but an organization is being created to maintain a well-considered and persistent endeavor to get larger financial resources for Engineering Foundation and the library as their opportunities for service develop.

**Braddock, Pa., Has New Generating Station.**—The United Electric Light Company of Wilmerding, Pa., last week opened a new eight-hundred-thousand-dollar generating station at First Street and the Monongahela River, Braddock. A dinner was served in the turbine room of the building to industrial officials of the Pittsburgh district and executives of companies in the Westinghouse valley. The new station, which has a capacity of 6,250 kva., but which has been designed for an ultimate capacity of 12,500 kva., will serve Wilmerding, East Pittsburgh, Turtle Creek, Wall, East McKeesport and Chalfant, North Versailles, Patton and Wilkins, Pa. This 40-square mile area which will be served by this new station has a population of 43,000. Current will be generated at 6,600 volts, three-phase, 60 cycles, and will be stepped up to 22,000 volts for transmission and down to 2,200 volts for distribution. The power station will be thrown into operation at midnight June 12.

**Tacoma Makes Filing for Second Unit of Cushman Plant.**—On the same day that President Coolidge, by pressing a key at the White House, recently set in motion the two generators at the first unit of the Lake Cushman plant, the new municipal venture of Tacoma, Wash., that city made its filing at Olympia for the second part of the project, this time asking for 600 sec.-ft. of the South Fork of the Skokomish River. The scheme of utilization has been outlined in previous issues of the ELECTRICAL WORLD. The South Fork flows down a rock ravine 4 miles west of the North Fork and will be made to feed into the existing 220,000-acre-ft. reservoir through the construction of a tunnel and a concrete dam 285 ft. high. The Lake Cushman undertaking will cost in all $7,500,000. A notable feature of the 60-mile transmission line is the nine-furlong span over the "Narrows" of Puget Sound, carried on 315-ft. steel towers which themselves stand on bluffs 220 ft. above the water, so that the cables at the lowest point of sag are 200 ft. above high water.

**Niagara, Lockport & Ontario Takes Up Municipal Offer.**—Through its president, Fred D. Corey, the Niagara, Lockport & Ontario Power Company has sent a communication to the Mayor and Council of Jamestown, N. Y., offering to sell the franchise and business of the company in that city to the municipality. This letter was in reply to the action of the local Board of Public Utilities, which recently, in rejecting an offer from the company to install general and ornamental street lighting, declared that the operation of both a private and a municipal system in the city was an "economically unsound policy" and that the only proposal that the city would consider would be one looking to the sale to it of the private company's franchise and business. The company says that if the city really wishes to discontinue the use of Niagara energy it stands ready to negotiate. A reply is requested by June 15, after which the company says, if negotiations are not authorized, it will proceed with its program to render permanent and competing service.

# Men of the Industry

## P. S. Young New Treasurer of N.E.L.A.

Percy S. Young, vice-president in charge of finance of the Public Service Electric & Gas Company, was elected treasurer of the National Electric Light Association at the recent convention in Atlantic City. After coming to this country from England, Mr.

P. S. YOUNG

Young lived on a ranch in western Nebraska, and his first affiliation in the public utility field was as an employee of the Omaha Gas Company in 1890, which company was controlled by the United Gas Improvement Company. Five years later he was appointed a traveling auditor by that holding company, but in 1898 he removed to Jersey City, where he became secretary and assistant treasurer of the Hudson County Gas Company.

When the Public Service Corporation of New Jersey was organized in June, 1903, he became comptroller of that organization and in 1914 treasurer. In 1915 Mr. Young was made vice-president in charge of finance of the operating companies controlled by the Public Service Corporation of New Jersey. In 1917 he was made vice-president of the Public Service Corporation of New Jersey, a member of the executive committee and a member of the board of directors of that company.

Mr. Young has been active in association work for many years. He is a past-president of the National Commercial Gas Association, the Eastern States Gas Conference and the American Electric Railway Accountants' Association. Mr. Young is a member of the board of directors of the American Superpower Corporation and of other organizations.

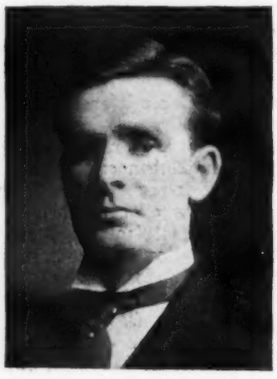
**David Hall,** power engineer with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been transferred to Los Angeles as manager of the engineering division for that district. Mr. Hall has taken a prominent part in designing some of the largest equipment produced by the Westinghouse company. A graduate of Lehigh University, he entered the employ of the company in 1908 after a connection with the Allis-Chalmers Manufacturing Company. For many years he has been engineer in charge of the design of all large direct-current power machinery and synchronous converters. His work in this capacity identified him with the production of some of the most notable electrical apparatus produced by the Westinghouse company.

**Emil Jorgenson,** formerly auditor of the Wisconsin Gas & Electric Company, has been promoted to the position of assistant secretary and assistant treasurer, with offices in Racine. Mr. Jorgenson has been affiliated with the Wisconsin utility for the past eighteen years.

## J. J. Cagney Receives Promotion

Jefferson J. Cagney, who has recently held the position of supervisor of the Western properties under the management of the General Engineering & Management Corporation, has been made manager of that corporation with headquarters at 165 Broadway, New York. The General Engineering & Management Corporation, among its other activities, is the engineering and management corporation for all Fitkin utilities—electric, gas, water, railway, ice, etc.—in the sixteen states in which these utilities operate.

Mr. Cagney will have charge of the New York organization of the General Engineering & Management Corporation, both in its service to the rapidly growing system of Fitkin properties and also in the development and administration of its business with other clients in the field of public utility engineering, construction, operating



J. J. CAGNEY

management and appraisal. Mr. Cagney brings to his new position an unusually broad knowledge of the public utility business acquired through the organization and management of numerous public utilities in the United States and Canada extending over more than 25 years. He has long been active in the affairs of the National Electric Light Association, American Gas Association, Illuminating Engineering Society and other organizations.

## J. M. Curtin Heads Power Club

J. M. Curtin, who was elected president of the Electric Power Club at the convention held last week in Hot Springs, Va., is affiliated with the Westinghouse Electric & Manufacturing Company in the capacity of industrial sales manager. Mr. Curtin entered the service of the Westinghouse company in 1898 immediately after his graduation from Pennsylvania State College. He spent three years in the apprenticeship course and in getting practical experience before joining the old alternating-current department, where he remained until 1903. In that year he became associated with the office of F. H. Taylor, the second vice-president of the company.

J. M. CURTIN

It was in 1905 that he was transferred back to East Pittsburgh, where he engaged in sales negotiation work for the industrial sales department. Promotion to the position of assistant to the manager of that department followed in 1909, and later he was advanced to the managership. Mr. Curtin's election to the presidency of the Electric Power Club was the outcome of a long and prominent connection with that society.

# Obituary

**William H. Forde,** electrical engineer with Stone & Webster, Inc., was killed in an automobile accident May 11 near Conowingo, Md. A native of Matick, Mass., and a graduate of the Sheffield Scientific School of Yale University in 1913, Mr. Forde entered the employ of Stone & Webster the following year. He was a member of the American Institute of Electrical Engineers.

**Thomas H. Fritts,** well known in public utility circles in Nebraska, died May 29 in Oakland, Neb., in his fifty-fifth year. Mr. Fritts had been in poor health for some time and had not been active in business affairs for the last three years. He had formerly been an official of the Grand Island (Neb.) central-station company for more than thirteen years and served twice as president of the Nebraska Section of the National Electric Light Association.

# Commission Rulings

**Exchange of Securities on Equitable Basis.**—In dealing with a joint petition from the Haverhill Electric Company and the Newburyport Gas & Electric Company for permission to consolidate, the Massachusetts Department of Public Utilities, finding that the Newburyport company's stock was worth 69.78 per cent as much as the Haverhill company's, refused to permit it to be exchanged for the latter company's stock on equal terms, notwithstanding operating advantages to accrue to the combined company merger. The department found that an exchange of the stock on the basis of seven to ten would be reasonable.

**Compulsory Ownership of Equipment.**—Declaring that the welfare of a community demands that a public utility shall own and maintain so far as practicable all its plant and equipment, the North Dakota Board of Railroad Commissioners ordered the Ellendale Electric Company to comply with the commission's rules to the above effect in the case of the Ellendale National Bank, which had installed steam mains and connections at its own expense and asked for a refund of their cost. The company pleaded the terms of a contract entered into prior to the commission's rule, but the commission said that to permit one customer to pay for equipment other customers received free would clearly be discriminatory and that the interpretation of contracts was not its function but that of the courts.

**Valuation of Land for Right-of-Way.**—Little weight was given by the Maryland Public Service Commission, in a case affecting the United Railways & Electric Company, to the theory that a right-of-way has a greater value than the adjoining land because of an assumed greater cost in procuring it. The commission said: "The people's counsel arrived at his figure by appraising the rights-of-way on the basis of the acreage value of adjoining property. The railway company arrived at its value by considering the value of adjoining property if this was subdivided into lots. This value was based upon the square foot value of lots 150 ft. in depth. Where the property was not subdivided, acreage figures as a basis of valuation were taken. After reaching this value the railway then multipled the figures thus reached by three, claiming that the cost of procuring a narrow strip in front of the property would be three times as great as the contiguous property itself. The people's counsel's figure not only included the rights-of-way in the country, but also the rights-of-way privately owned in the new annex, which latter properties are included in the company's claim for easements." The commission agreed upon the value of the property as determined by the railways, but without the multiplier as the fair value of the rights-of-way, asserting that it did not believe that the rights-of-way were three times as valuable as the adjoining property. "It recognizes that the company would probably be held up in some cases in trying to secure these rights-of-way, but it also recognizes the fact that many property owners would donate the rights-of-way for the advantage of securing a car line in front of their property."

**Company Authorized to Sell Energy to Municipal Plant but Not to Compete with It.**—Authorizing the Tilton Electric Light & Power Company to sell energy to the Belmont municipal plant, the New Hampshire Public Service Commission stipulated that this must be the extent of its service in Belmont, which is also supplied by the Laconia Gas & Electric Company. "It is not in the public interest," said the commission, "that the Tilton company should be given general authority to operate as a public utility in Belmont, as it is not desirable to have two utilities operating as competitors in the same territory. Duplication of service is costly, uneconomical, and the added burden eventually has to be borne by the public."

# Recent Court Decisions

**Exacting Care Required from Possessor of Electrical Appliances to Which Children Have Access.**—A boy patient in a private hospital while playing with an electric cord suspended over his bed to enable him to call the nurse placed the push-button end in his mouth and received injury owing, as alleged, to the unsafe condition of the appliance, from which a screw had dropped (Hindal vs. Kahler Corporation). The Supreme Court of Minnesota sustained a verdict for $1,000, holding that a high degree of care must be exercised by the possessor of such appliances, and especially so where children are concerned, and that the questions of negligence by the defendant and contributory negligence by the boy were for the jury to decide. (208 N. W. 524.)*

**Power Company May Appropriate Lands for Dam Without Obtaining Authority from Legislature or Commission.** — The Indiana Hydro-Electric Company obtained the right to condemn for the erection of a dam riparian property owned by Harry Lowe and others, who thereupon brought suit, alleging many reasons why the judgment should be upset. The Supreme Court of Indiana has overruled all their contentions. Some of its findings are: (1) The owner of lands on both sides of a non-navigable stream may use water flowing over his land for any lawful purpose not interfering with the natural flow of the water off the land or injurious to owners further down stream. (2) A legislative grant of right to use such waters by erecting a dam not injurious to others is not necessary. (3) Owner of such a site can condemn lands for the purpose of developing water power. (4) A company proceeding to do this does not need to obtain a certificate of public convenience and necessity from the Public Service Commission. (5) Lease by such a company to another public utility of power manufactured at its plant does not affect its power of eminent domain. (6) The operation of a mill by water power to manufacture electricity to be sold to the public constitutes a public use for which lands may be appropriated. (7) A petition by an electric company for the appointment of appraisers of land sought to be condemned for the construction of a dam presents only questions whether the appropriation may be authorized for such use, whether the plaintiff has necessary power and whether it has proceeded properly, and does not involve an issue as to the relative benefits and damages that would result from the proposed dam, and evidence on such issue was properly excluded. (151 N. E. 220.)

**City's Right to Compel Electric Light Company to Safeguard High-Tension Wires.**—State vs. West Missouri Power Company was an action to oust the company from its occupancy with an electric distributing system of the streets of Warrensburg, Mo. The Missouri Supreme Court reversed a judgment of ouster, holding that the appellant's franchise was in perpetuity, though subject to forfeiture for misuser, nonuser or abandonment. The cause of the suit was the introduction into the city against determined public opposition of 22,000-volt lines. These lines led to the local power house, where the voltage was stepped down for distribution. The Supreme Court found that the city had ample police power which it did not and could not surrender and that there could be no doubt of its ability to compel the company, in bringing the high-tension line into the city, to do so in such a manner and under such safeguards as would effectually protect the citizens from the apprehended dangers. (281 S. W. 709.)

**Right of Jury to Determine Disputed Facts Concerning Trespassing and Negligence.**—The right of the trial jury to determine the facts regarding trespass and negligence has been sustained by the Supreme Court of Oregon in Cooper vs. North Coast Power Company. The jury awarded damages for the death from electric shock of a young boy who climbed a tree that had been sawed off by the company in such a way that one climbing to the top could easily come in contact with uninsulated and inconspicuous high-tension wires. The tree was described as forming a particularly attractive climbing place for boys. It was on the company's right-of-way, and the owner of the land had posted trespass notices, but it did not appear that any warning against the wires was given to the boy, who formed one of a picnic party in charge of a teacher, the school authorities not regarding the trespass notices as applicable to "neighbors." A motion for an instructed verdict for the company was, therefore, properly denied, the Supreme Court held. (244 Pac. 665.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Financial and Corporate

## Utility Stocks Advance

**Substantial Buying Orders in Week's Activities—Ease in Money Rates a Factor**

SENTIMENT in the securities market continued cheerful during the week under review, and resultant advances in the public utility stock group were made. Several factors, chief among which was the ease in money rates, contributed to the generally improved tone.

That confidence in the securities market is gradually being restored was clearly indicated by the steady inflow of buying orders that entered into the week's transactions. Buying for investment purposes, as may be judged by the better quality of securities in demand, accounted for a large portion of the business, and numerous advances of one to two points may be noted in various sections of the list.

Senior shares retained the position which they held at the close of the previous period. Major interest was focused upon the preferred shares of American Public Utilities, Arkansas Light & Power, Middle West Utilities, Nebraska Power, United Gas & Electric, Fort Worth Power & Light, Utah Power & Light and Cleveland Electric Illuminating, all of which closed the week moderately higher.

Though larger gains were enjoyed by several common stocks, the main body of issues failed to show any marked appreciation in values. Nevada-California Electric and United Gas Improvement registered respective gains of four and two and a quarter points. Columbia Gas & Electric scored a run-up of several points. Middle West Utilities common added more than two points to previous levels, while American Light & Traction, Southeastern Power & Light and American Gas maintained firm levels.

## Northern States Power 1925 Annual Report

Improved agricultural and business conditions in the North Central States during the last year are reflected in the annual report of the Northern States Power Company of Delaware for the twelve months ended Dec. 31, 1925, recently issued. Gross earnings for the period amounted to $21,744,868 against $20,227,211, an increase of 9.89 per cent, while net earnings totaled $10,594,275, as compared with $9,417,316, an increase of 14.26 per cent. The large increase in net earnings as compared with the increase in gross earnings is attributed by President John J. O'Brien to greater operating efficiency and economies. The ratio of operating expenses to gross revenue continues to decrease, he points out, being 51.09 per cent for 1925, as compared with 52.96 per cent in 1924 and 56.78 per cent in 1923. These figures are exclusive of those for the Ottumwa Railway & Light Company, which was sold as of May 31, 1925. Approximately 88.1 per cent of the gross earnings and 94.3 of the net earnings were derived from the sale of electricity.

New construction and extensions to provide for the constantly growing demand for services called for the investment of $5,837,313 by the Northern States Power Company during 1925, and the budget for 1926 provides for the additional investment of $5,534,000. Output of electrical energy for the year exceeded 742,601,203 kw.-hr., as compared with 689,576,716 kw.-hr. in 1924.

## Customer Sales Reach Total of $28,350,000 in March

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power customers and employees, it is estimated that during March a total of 285,500 shares were sold in this manner. The total value of the stock sold, estimated at $28,350,000, fell $5,350,000 short of the sales reported in March last year. A total of 55,250 customers took part in the sales during March.

## New Capital Issues

First mortgage sinking fund gold bonds of the Ohio River Edison Company amounting to $4,000,000 were offered during the past week at 93½ and accrued interest, to yield about 5.50 per cent. Funds obtained from the sale of these bonds will be used for extensive additions.

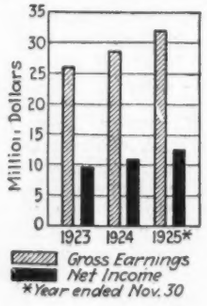
An interesting piece of financing was that done by the Stettin Public Utilities Company, Stettin, Germany, which controls the utility companies supplying that city wies electric light and power, gas, tramway and water services. First (closed) mortgage sinking fund 7 per cent gold bonds of that company to the amount of $3,000,000 were offered the investing public, the price being 94½ and interest, to yield about 7.55 per cent.

# National Power & Light Company's Set-up

**Recent Mergers in Carolina Power & Light Group Strengthen Financial Structure of Parent—Electric Service Provides 60 per Cent of Business**

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

ATTENTION has been directed anew to the National Power & Light Company through that utility's continued growth, but more especially through a merger of several properties with the Carolina Power & Light Company, one of the National's subsidiaries.




EARNINGS OF NATIONAL POWER & LIGHT COMPANY COVERING THREE-YEAR PERIOD

The National Power & Light Company belongs in the group of utilities that are supervised by the Electric Bond & Share Company, and it owns directly or through subsidiaries the common stock of the Birmingham Electric Company, Carolina Power & Light Company, Houston Lighting & Power Company, Jackson (Tenn.) Railway & Light Company, Knoxville Power & Light Company, Memphis Power & Light Company and Memphis Street Railway Company. Of these the National Power & Light Company owns the entire outstanding issues of common stock except directors' shares.

The capital structure of the National Power & Light Company is simple, consisting of only three outstanding issues of securities. These are as follows: (1) An issue of 50-year 7 per cent income bonds that mature in 1972, totaling $8,558,100; (2) 2,562,195 shares of common stock, and (3) 140,942 shares of cumulative seven-dollar preferred stock. A 100,000-share of cumulative six-dollar preferred stock has been authorized but not issued.

According to a statement made earlier in the year by H. C. Abell, president of the National Power & Light Company, "earnings applicable to payment of dividends on preferred stock for the twelve months ended Nov. 30, 1925, were equal to four times annual dividend requirements on all preferred stock."

During the course of recent years the proportion of the total earnings that flow in from the electrical services have been increasing, and last year, it is reckoned, electric power and light activities contributed about 60 per cent of the total revenues, railway operations 29 per cent, manufactured gas 10 per cent and miscellaneous activities 1 per cent.

One of the more interesting developments of late in the system has been the merger and consolidation of the Carolina Power & Light Company (old), Yadkin River Power Company, Asheville Power & Light Company, Pigeon River Power Company and the Carolina Power Company into the Carolina Power & Light Company. This prosperous subsidiary of National Power & Light supplies electric light and power service to 130 communities in North and South Carolina. The purpose of the consolidation was to stabilize output and increase the service continuously available. The plan paves the way for a big construction program which will, it is figured, make for a more rapid development of industry in the territory served by the system.

## New Issues in May Total $66,316,000

New public offerings of electric light and power securities during the month of May, including stock, bond and note issues, amounted to $66,316,000, as compared with $86,373,000 for the same month of 1925. This figure brings to a close the five-month period with a total of $560,561,442, as against $501,448,000 for the corresponding period of the previous year.

The largest individual offering was made by the Indianapolis Power & Light Corporation, which utility, incidentally, was represented twice in the month's list of new issues, in the form of first collateral trust gold bonds amounting to $10,000,000. Though long-term financing predominated, several short-term issues appeared.

## Dividends Declared

The quarterly dividends listed below were recently announced by electric light and power and electrical manufacturing companies:

| Name of Company | Per Cent | When Payable |
|---|---|---|
| Associated Gas & Elec., $7 pf. | $1.75 | July 1 |
| Associated Gas & Elec., orig. pf. | .87½ | July 1 |
| Associated Gas & Elec., orig. pf. ex. | .12½ | July 1 |
| Barcelona Trac., Lt. & Pwr., ptc. pf. | 1¾ | June 30 |
| Buffalo, Niagara & East., Pwr., com. | .25 | July 1 |
| Buffalo, Niagara & East. Pwr. pf. | .40 | July 1 |
| Cities Service, com.* | ½ | July 1 |
| Cities Service, com.† | ½ | July 1 |
| Cities Service, pf. & pf. B.* | ½ | July 1 |
| Consolidated Gas, N. Y., pf. | .87½ | Aug. 2 |
| Continental Gas & Elec., com. | $1.10 | July 1 |
| Continental Gas & Elec., pf. | $1.50 | July 1 |
| Continental Gas & Elec., ptc., pf. | $2 | July 1 |
| Detroit Edison | 2 | July 15 |
| Eastern Texas Elec., pf. | 1¾ | July 1 |
| Electric Pwr. & Lt., pf. | $1.75 | July 1 |
| Elec. Vacuum Cleaner | $1 | July 1 |
| Elec. Vacuum Cleaner, com. extra | $1 | July 1 |
| Elec. Vacuum Cleaner, pf. | 1¾ | July 1 |
| Engineers Pub. Serv., pf. | $1.75 | July 1 |
| General Elec., new com. | .75 | July 15 |
| General Elec., new com.‡ | $1 | July 15 |
| General Elec., special stk. | .15 | July 15 |
| General Gas & Elec., com. A | .37½ | July 1 |
| General Gas & Elec., $8 pf. A | $2 | July 1 |
| General Gas & Elec., $7 pf. A | $1.75 | July 1 |
| General Gas & Elec., $7 pf. B | $1.75 | July 1 |
| Illinois Power, 6% pf. | 1½ | July 1 |
| Illinois Power, 7% pf. | 1¾ | July 1 |
| Indiana Service, pf. | 1¾ | June 1 |
| Interstate Power, pf. | $1.75 | July 1 |
| Kans. City Pwr. & Lt., 1st pf. A | $1.75 | July 1 |
| Kentucky Hydro-Elec., pf. | 1¾ | June 21 |
| Manila Elec., com. | .50 | July 1 |
| Manila Elec., com. | .50 | Oct. 1 |
| Manila Elec., com. | .50 | Dec. 31 |
| Montana Power, com. | 1¾ | July 1 |
| Montana Power, pf. | 1¾ | July 1 |
| National Pwr. & Lt., pf. | $1.75 | July 1 |
| National Pub. Serv., com. A | .40 | June 15 |
| Newport News & Hampton Ry., Gas & Elec., com. | 1½ | July 1 |
| Newport News & Hampton Ry., Gas & Elec., pf. | 1¾ | July 1 |
| Niagara Falls Pwr., com. | .50 | June 30 |
| Niagara Falls Pwr. pf. | .43¾ | July 15 |
| Niagara, Lockport & Ont. Pwr., com. | .50 | June 30 |
| Niagara, Lockport & Ont. Pwr., pf. | 1¾ | July 1 |
| North American Co., com. | 2½ | July 1 |
| North American Co., 6% pf. | .75 | July 1 |
| Northwestern Publ. Serv., pf. | 1¾ | June 1 |
| Ottawa Lt., Ht. & Pwr., com. | 1½ | June 30 |
| Ottawa Lt., Ht. & Pwr., pf. | 1¾ | July 1 |
| Pennsylvania Pwr. & Lt., pf. | $1.75 | July 1 |
| Pennsylvania Wtr. & Pwr. | 25 | July 1 |
| Public Service of N. J., com. | $1.25 | June 30 |
| Public Service of N. J., 6% pf. | 1½ | June 30 |
| Public Service of N. J., 7% pf. | 1¾ | June 30 |
| Public Service of N. J., 8% pf. | 2 | June 30 |
| Public Service Elec. & Gas., 6% pf. | 1½ | June 30 |
| Rochester Gas & Elec., pf. B. | 1¾ | June 1 |
| Rochester Gas & Elec., pf. C and D | 1½ | June 1 |
| Southern Calif. Edison, pf. A | 1¾ | June 15 |
| Southern Calif. Edison, pf. B | 1½ | June 15 |
| Tenn. East Elec., com. | $1 | July 1 |
| Tenn. East. Elec., 7% pf. | 1¾ | Sept. 1 |
| Tenn. East. Elec., 6% pf. | 1½ | Sept. 1 |
| Utilities Pwr. & Lt., A | .50 | July 1 |
| Utilities Pwr. & Lt., B | .25 | July 1 |
| Utilities Pwr. & Lt., 7% pf. | 1¾ | July 1 |
| Virginia Publ. Serv., pf. | 1¾ | July 1 |
| Wisconsin Publ. Serv., 7% cum. pf. | $1.75 | June 1 |
| Worthington Pump & Mach., pf. A | 1¾ | July 1 |
| Worthington Pump & Mach., pf. B | 1½ | July 1 |
| Yale & Towne Mfg. | $1 | July 1 |

* Monthly. † Payable in common stock. ‡ Payable in special stock.

**Utica Utility to Change Set-Up.**—Stockholders of the Utica Gas & Electric Company met at the company's office in Utica, N. Y., and unanimously favored the following six proposals: (1) To reduce the number of authorized shares of the non-voting cumulative preferred stock from 80,000 to 60,000 shares; (2) to authorize in lieu of the 40,000 shares of common stock of the par value of $100 now authorized by the certification of incorporation 400,000 shares of common stock without any nominal or par value; (3) to

## Security Issues of Electric Service Companies in May

| Name of Company | Amount of Issue | Period Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Utica Gas & Electric Co. | $6,000,000 | 30 | General mortgage gold bonds, series D | To reimburse the company in part for expenditures on additions and extensions. | 5 | 100 | 5 |
| Florida Public Service Co. | 1,766,000 | 29 | First mortgage gold bonds, series B | | 6 | 98 | 6.15 |
| Utilities Power & Light Corp. | 2,500,000 | .. | Cumulative preferred stock | To provide for expenditures made in connection with investments in subsidiaries | 7 | 95 | 7.35 |
| General Public Utilities Co. | 6,300,000 | 30 | First mortgage and collateral trust gold bonds | To acquire or retire indebtedness of subsidiaries and to provide funds for the acquisition of properties, construction and other corporate purposes | 6½ | 98 | 6.65 |
| Montana-Dakota Power Co. | 1,500,000 | 3 | First mortgage bold bonds | For acquisition of properties, to reimburse for improvements and to pay for new additions | 5½ | 99.75 | 5.60 |
| Penn-Ohio Edison Co. | 1,500,000 | .. | Cumulative prior preference stock | To reimburse for expenditures on extensions to subsidiary properties | 7 | 96 | 7.30 |
| Indianapolis Power & Light Corp. | 10,000,000 | 10 | First collateral trust gold bonds series A | | 6 | 98 | 6.25 |
| | 3,800,000 | .. | First preferred stock | | 7 | 95 | 7.37 |
| Mississippi Power Co. | 1,750,000 | 29 | First and refunding mortgage gold bonds | Construction | 5 | 95 | 5.33 |
| Blackstone Valley Gas & Electric Co. | 4,000,000 | 25 | Mortgage and collateral trust gold bonds, series A | To retire certain indebtedness and for construction | 5 | 100 | 5 |
| Iowa Power & Light Co. | 3,000,000 | 30 | First mortgage gold bonds, series B | Construction | 5½ | 99 | 5.55 |
| Central Maine Power Co. | 2,500,000 | 29 | First and general mortgage gold bonds, series D | To reimburse for expenditures for construction and for other corporate purposes | 5 | 100 | 5 |
| City Light & Traction Co. (Sedalia, Mo.) | 700,000 | 1 | Gold notes | To retire maturing notes and for other corporate purposes | 5 | 100 | 5 |
| Northeastern Iowa Power Co. | 300,000 | 1 | Gold notes | | 5 | 99½ | 5.52 |
| Washington Water Power Co. | 5,000,000 | 30 | General mortgage gold bonds | To retire certain indebtedness and for extensions and improvements | 5 | 100¾ | 4.95 |
| Galveston-Houston Electric Co. | 2,000,000 | 5 | Secured gold notes, series A | To reimburse for cost of new acquisition | 6½ | 97.92 | 7 |
| Northern Ohio Power & Light Co. | 8,500,000 | 25 | General and refunding mortgage gold bonds | To retire certain debt, to reimburse for expenditures on additions and for other corporate purposes | 5½ | 92½ | 6.09 |
| Old Dominion Power Co. (Va.) | 2,500,000 | 25 | First mortgage gold bonds | To pay in part cost of acquisition of properties | 5 | 94 | 5.45 |
| Interstate Power Co. (Del.) | 2,700,000 | 18 | First mortgage gold bonds | To reimburse for expenditures on additions and for other corporate purposes | 6 | 100 | 6 |
| Total | $66,316,000 | | | | | | |

change all shares of the common stock of the company which have a par value of $100 into shares without a nominal or par value; (4) to change the shares of common stock which have a par value of $100 per share for shares of common stock without any nominal or par value, on the basis of ten shares of common stock without par value for each share of the common stock now outstanding; (5) to create an issue of 100,000 shares of a new class of preferred stock without nominal or par value, bearing cumulative dividends at the rate of $6 per share per annum; (6) to reduce the authorized number of shares of the present 7 per cent preferred stock to the number of shares now issued and outstanding, and to sell only the new six-dollar preferred stock.

**Southern California Edison Application Approved.**—The application of the Southern California Edison Company to issue $40,000,000 of 5 per cent refunding mortgage bonds has been granted by the Railroad Commission.

## Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Saturday May 29 | Low 1926 | High 1926 |
|---|---|---|---|
| **STOCKS** | | | |
| ABITIBI PWR. & PAPER, com. —no par | k 73¼ | 70¼ | 84½ |
| Adirondack Pwr. & Lt.—7% pf. | k103 | .... | .... |
| Adirondack Pwr. & Lt.—8% pf. | 112 | 108 | 113 |
| Ala. Pwr., pf. | k105½ | .... | .... |
| Allis-Chalmers Mfg. pf. | 110 | 105 | 110½ |
| Allis-Chalmers Mfg., com. | k 82 | 78¼ | 94½ |
| Aluminum Co. of Amer., com. | k 63 | .... | .... |
| Aluminum Co. of Amer. new, pf. | k 99½ | 98½ | 101 |
| Amer. & Foreign Pwr., pf. 25% pd. | m108 | 108 | 131 |
| Amer. & Foreign Pwr., 7% pf.—no par | k 89½ | 89 | 98 |
| Amer. & Foreign Pwr., com.—no par | k 19 | 15½ | 42½ |
| Amer. Bosch Magneto, com—no par | k 20½ | 16 | 34½ |
| Amer. Brown Boveri, Elec. | k 35½ | 30½ | 48½ |
| Amer. Brown Boveri Elec pf. | 95½ | 86½ | 97½ |
| Amer. Elec. pwr., pf. | c110½ | 102½ | 111½ |
| Amer. Gas & Elec., 6% pf.—no par. | k 92 | .... | .... |
| Amer. Gas & Elec., com.—no par | k 73½ | 64 | 99½ |
| Amer. Lt. & Trac., 6% pf. | 105 | 105 | 115½ |
| Amer. Lt. & Trac., com. | k207 | 195 | 263 |
| Amer. Pwr. & Lt., 6% pf. | k 93½ | 92 | 96 |
| Amer. Pwr. & Lt., com.—no par | k 54 | 50½ | 54 |
| Amer. Pub. Serv., 7% pf. | k 94 | .... | .... |
| Amer. Pub. Serv., com. | 47 | 45 | 80 |
| Amer. Pub. Utilities, 6% pf. | k 87 | .... | .... |
| Amer. Pub. Utilities, 7% pf. | k 92 | .... | .... |
| Amer. Pub. Utilities, com. | 70 | 80 | 82 |
| Amer. States Sec., A | k 2½ | .... | .... |
| Amer. States Sec. B | k 2½ | .... | .... |
| Amer. Superpwr., pf.—25 | 24½ | 23 | 26½ |
| Amer. Superpower, pf. | 92 | 90 | 94 |
| Amer. Superpwr., Class A—no par. | k 22½ | 19½ | 37½ |
| Amer. Superpwr., Class B—no par. | k 23½ | 21½ | 39 |
| Amer. Wtr. Wks. & Elec., 7% pf. | 103 | 101½ | 108½ |
| Amer. Wtr. Wks. & Elec., com.—20. | k 51½ | 43½ | 74 |
| Anaconda Copper | k 45½ | 41½ | 51 |
| Appalachian Pwr., 7% pf. | 100 | 99 | 101 |
| Appalachian Pwr., 1st pf., 7% | 100 | 99 | 102 |
| Appalachian Pwr., com. | 80 | 80 | 83 |
| Arizona Pwr., 7% pf. | k 78 | .... | .... |
| Arizona Pwr., com. | m 27 | 27 | 35½ |
| Arkansas Cent. Pwr., pf., $7—no par | 103 | 99 | 102 |
| Arkansas Lt. & Pwr., 7% pf. | 98½ | 96 | 102 |
| Arkansas Lt. & Pwr., com. | 100 | 110 | 115 |
| Asheville Pwr. & Lt., 7% pf. | l105 | 100½ | 105½ |
| Assoc. G.&E., pf.—$3.50—50 | k 50 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | k 83½ | .... | .... |
| Assoc. Gas & Elec., Class A—no par | k 30 | 25½ | 35½ |
| BABCOCK & WILCOX, com. | k114½ | .... | .... |
| Binghamton Lt., Ht. & Pwr., pf. | 105 | 105 | 110 |
| Birmingham Elec. pf.—$7—no par. | 104 | 101 | 105 |
| Blackstone Valley Gas & Elec., pf. | 103 | 103 | 106 |
| Blackstone Valley G.&E., com.—50. | 95 | .... | .... |
| Blaw-Knox, com. | f 51½ | 45 | 56 |
| Brazilian Trac., Lt. & Pwr., com. | f 97½ | .... | .... |
| Broad River Pwr., pf. | k 93½ | .... | .... |
| Brooklyn Edison, com. | k140 | 133 | 146½ |
| Buffalo, Niagara & East. Pwr., pf.—25 | k 24½ | .... | .... |
| Buffalo, Niagara & Eastern Pwr., com.—no par | k 26½ | .... | .... |
| CALIFORNIA ELEC. GENERATING, pf. | 93 | 89 | 95 |
| California Ry. & Pwr., pf. | 105 | 88 | 115 |
| Carolina Pwr. & Lt., pf.—$7—no par | 105 | 102 | 107 |
| Cent. & S. W. Ut. 7% pf.—no par | a 91 | 89½ | 95 |
| Cent. & S. W. Ut., pr. lin. pf.—no par | a 94 | 94 | 100 |
| Central Ariz. Lt. & Pwr., pf. | 102 | .... | .... |
| Central Ark. Ry. & Lt., 7% pf. | k 98 | .... | .... |
| Central Ill. Pub. Serv., 6% pf. | 88 | 89 | 91 |
| Central Ind. Pwr., 7% pf. | 87 | 87 | 93½ |
| Central Pwr. & Lt., pf. | 95½ | 94 | 98½ |
| Central States Elec., 7% pf. | k 92 | .... | .... |
| Central States Elec., com. | m200 | 200 | 230 |
| Century Elec., com. | b115 | 110 | 116 |
| Chicago Fuse Mfg., com., no par. | a 30½ | 30½ | 35 |
| Cincinnati Gas & Elec., com. | g 90 | 88 | 93½ |
| Cities Service, 6% pf. | 86½ | 82½ | 86½ |
| Cities Service, pf. B—10. | m 7½ | 7½ | 7½ |
| Cities Service, pf. BB—100. | 74 | 74 | 76 |
| Cities Service, com.—20. | 40½ | 37½ | 42½ |
| Cities Service, Bks. Shrs.—10. | m 20 | .... | .... |
| Clarion River Pwr., pf. | 93 | 93 | 95 |
| Cleveland Elec. Illg., 6% pf. | 105 | 103 | 105½ |
| Cleveland Elec., Illg., com. | k289 | .... | .... |
| Colorado Pwr., 7% pf. | k 95 | .... | .... |
| Columbia Gas & Elec., 7% pf. | k112½ | 112 | 115 |
| Columbia Gas & E., com.—no par. | k 81½ | 63½ | 90 |
| Columbia Ry., Gas & Elec., 6% pf. | 90 | 65 | 96 |
| Columbus Elec. & Pwr., 2d pf. | k103 | .... | .... |
| Columbus Elec. & Pwr., com. | k250 | .... | .... |
| Columbus Ry., Pwr. & Lt., 1st. pf. | 98 | 98 | 99½ |
| Columbus Ry., Pwr. & Lt., pf. B. | 94 | 92 | 97 |
| Col. Ry., Pwr. & Lt., com.—no par. | 75 | 75 | 85 |
| Commonwealth Edison, com. | a141 | 137½ | 144 |
| Commonwealth Pwr., 6% pf. | k 85½ | .... | .... |
| Commonwealth Pwr., com—no par. | k 34½ | 28½ | 42½ |
| Conn. Lt. & Pwr., 8% pf. | 116 | 117 | 121 |
| Conn. Lt. & Pwr., 7% pf. | 107 | 108 | 113 |
| Cons. Gas of N. Y., pf.—50. | k 57½ | .... | .... |
| Cons. Gas of N.Y., com.—no par. | k 96 | 87 | 104½ |
| Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf. | c104½ | 102 | 105 |
| Cons. Gas. Elec. Lt. & Pwr. of Balti 6½% pf | c111 | 108½ | 111 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti.. 7% pf. | c113 | 109 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf. | c127½ | 124 | 128½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par. | e 49½ | 45 | 57½ |
| Cons. Pwr. & Lt., 7% pf. | 104 | 100 | 107 |
| Consumers Pwr., 6% pf. | 97½ | 95 | 98 |
| Consumers Pwr., 6.6% pf. | 106 | 101½ | 103½ |
| Continental Gas & Elec., 7% pfc. pf | k 97½ | .... | .... |
| Continental Gas & Elec., 7% pr pf. | k 96 | .... | .... |
| Continental G.&E., com.—no par. | 105 | 85 | 150 |
| Crocker Wheeler, com. | k 18 | .... | .... |
| Crocker Wheeler, pf. | k 56 | .... | .... |
| DALLAS PWR. & LT., 7% pf. | 103 | 102 | 104 |
| Dayton Pwr. & Lt., 6% pf. | 99 | 95 | 97 |
| Detroit Edison, com. | k132 | 123½ | 141½ |
| Dubilier Condenser & Radio, com. no par | k 5½ | 4½ | 11 |
| Dubuque Elec., 6% pf. | 98 | 93 | 97 |
| Duquesne Lt., 7% pf. | 112 | 111 | 113 |
| EAST, N. Y. UTIL, pf. | 80 | 80 | 85 |
| Eastern New York Utli., com. | 65 | 70 | 75 |
| Eastern States Power. | 14 | 23 | 32½ |
| Eastern States Pwr., pf. | k 86 | .... | .... |
| Eastern Tex. Elec., 7% pf. | k103 | .... | .... |
| East. Tex. Elec., com.—no par. | 75 | 103 | 107 |
| Edison Elec. Illum. of Boston, com. | d230 | 207 | 250 |
| E. Paso Elec., com.—no par | 70 | 70 | 94[f] |
| E. Paso Elec. pf. | 102 | 102 | 104[g] |
| Elec. Bond & Share, 6% pf. | l106½ | 103½ | 107½ |
| E. Bd. & Share Sec., com.—no par. | l 67 | 56½ | 86 |
| El. Household Utll. | a 17 | 13½ | 25 |
| Elec. Investors, 6% pf.—no par. | 87 | 87 | 95 |
| Elec. Investors, com.—no par. | 34 | 30½ | 74½ |
| Elec. Investors, 10% pd. receipts. | 16 | 12 | 56 |
| Elec. Pwr. & Lt., ctfs., pf. | k 93 | 89½ | 97½ |
| Elec. Pwr. & Lt., ctfs., 40% pd. | k100½ | 99½ | 115 |
| Elec. Pwr. & Lt., ctfs. full pd. | 104 | 103 | 110½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | k 17½ | 15¾ | 34½ |
| Elec. Ry. Securities, com.—no par. | m6 | 4½ | 10 |
| Elec. Refrig. | k 67½ | 62 | 67½ |
| Elec. Storage Battery, com.—no par. | k 77½ | 71½ | 79½ |
| Elmira Wtr., Lt. & R. R., 7% pf. | 98 | 97½ | 99½ |
| Emerson Elec. pf. | m103 | 100 | 104½ |
| Empire Dist. Elec., 6% pf. | 80 | 80 | 85 |
| Empire Pwr., A | k 21 | .... | .... |
| Eng. Pub. Serv., pf.—no par. | 102½ | 99½ | 104½ |
| Engr. Pub. Serv., com.—no par. | k 23 | 21 | 29½ |
| Eureka Vac. Cleaner, com.—no par. | k 48½ | 43 | 53½ |
| FAIRBANKS MORSE, com—no par | k 49½ | 46 | 59½ |
| Fairbanks Morse, pf. | k112 | 108½ | 115 |
| Federal Lt. & Trac., com. | 30½ | 28 | 39½ |
| Federal Light & Traction, pf. | 86½ | 87 | 89 |
| Federal Utilities, pf. | k 70 | .... | .... |
| Federal Utilities, com. | k 17 | .... | .... |
| Ft. Worth Pwr. & Lt., 7% pf. | l106½ | 105 | 108 |
| GALVESTON-HOUSTON ELEC., 6% pf. | k 44 | .... | .... |
| Galveston-Hstn El., com. | k 14 | .... | .... |
| Gen. Elec., new | k 80½ | 79½ | 80½ |
| Gen. Elec., com. | k321½ | 285 | 386½ |
| Gen. Elec., special—10. | k 11½ | 11 | 11½ |
| Gen. G.&E., (Del.) com. A no par. | k 40½ | 34 | 59 |
| Gen. G.&E., (Del.) com. B no par. | k 32 | 28 | 45½ |
| Gen. G.&E., (Del.) A pf. $8—no par | 107 | 105½ | 110½ |
| Gen. G.&E., (Del.) A pf. $7—no par | 96 | 95 | 99½ |
| Gen. G.&E., (Del.) B pf. | 93½ | 92½ | 96 |
| General Public Service, pf. | 104 | 90 | 106½ |
| General Public Service, com. | k 14½ | 12½ | 16½ |
| Ga. Lt., Pwr. & Rys., 6% pf. | 85 | 82 | 86 |
| Ga. Lt., Pwr. & Rys., com. | m 57½ | 56½ | 73½ |
| Ga. Ry. & Pwr., 8% pf. | 112 | 112 | 114 |
| Ga. Ry. & Pwr., 7% pf. | 101½ | 100½ | 103 |
| Ga. Ry. & Pwr., 4% pf. | 125 | 105 | 145 |
| Ga. Ry. & Pwr., com. | k115 | .... | .... |
| Gt. Western Pwr., 7% pf. | k100½ | .... | .... |
| HAVANA ELEC. UTIL., com. | m 39 | 37½ | 44½ |
| Havana Elec. Util., pf. | k 75 | 64½ | 75 |
| IDAHO PWR., 7% pf. | 103 | 103 | 104 |
| Ill. No. Utilities, 6% pf. | a 91 | 90 | 92 |
| Ill. Pwr. & Lt., 7% pf. | k 97 | .... | .... |
| Ingersoll Rand | 91½ | 80½ | 104 |
| Int. Combus. Engr., com.—no par. | k 52½ | 33½ | 64½ |
| Int. Utilities, class A—no par. | 31 | 31 | 39 |
| Int. Utilities, class B—no par. | 4½ | 4½ | 9½ |
| Interstate Pwr., pf., $7 no par. | k 94 | .... | .... |
| Interstate Pub. Serv., 7% pf. | 96 | 96½ | 98 |
| Iowa Ry. & Lt., 7% pf. | 95 | 98 | 100 |
| JERSEY CENTRAL PWR. & LT. 7% pf. | 94½ | 95 | 97½ |
| Jersey Central Pwr. & Lt., pfc. pf. | 95½ | 95½ | 96½ |
| Jersey Central Pwr. & Lt., com.—no par | 45 | 45 | 50 |
| Johns-Manville, com.—no par. | k139 | .... | .... |
| KANSAS CITY PWR. & LT., pf. | k111½ | 107½ | 111½ |
| Kansas Gas & Elec., 7% pf. | l101½ | 99 | 102 |
| Kentucky Hydro-Elec., pf. | a 93 | 91½ | 95 |
| Kentucky Sec., 6% pf. | 78 | 75 | 79 |
| Kentucky Sec., com. | 100 | 90 | 105 |
| Kentucky Utilities, 6% pf. | 92 | 90 | 95 |
| Keystone Pwr. & Lt. 7% pf. | 95 | 95 | 97 |
| Kings County Ltg., 7% pf. | 102 | 101 | 106 |
| Kings County Ltg., 8% pf. | 103 | 105 | 108 |
| LACLEDE GAS LT., com. | 155 | 146 | 168 |
| Lehigh Pwr. Sec., com.—no par. | k 13½ | 10 | 23 |
| Long Island Ltg., 7% pf. | 106½ | 105 | 108 |
| Long Island Ltg., com.—no par. | 115 | 120 | 150 |
| Los Angeles Gas & Elec., 6% pf. | k 96 | .... | .... |
| Louisville Gas & Elec., Class. A. | k 23½ | 22½ | 26½ |
| MANHATTAN ELEC. SUPPLY. | k 75 | 56 | 76½ |
| Manila Elec., com.—no par. | 39 | 27½ | 39½ |
| Maytag Mfg., com. | k 21½ | 19 | 23½ |
| Memphis Pwr. & Lt., pf., $7, no par | 104 | 103 | 105½ |
| Metro. Edison, pf.—$6—no par. | k 92 | .... | .... |
| Metropolitan Edison, pf., $7, no par. | 103 | 102 | 106 |
| Metropolitan Edison, com., no par. | 45 | 45 | 50 |
| Middle West Utilities, 7% pf. | a104½ | 97½ | 111½ |
| Middle West Utilities, 7% pr. lien pf. | a117 | 106½ | 123½ |
| Middle West Utilities, com.—no par. | a113½ | 108 | 134½ |
| Midland Utilities, pr. ln. pf. | a 98½ | 98 | 100 |
| Midland Utilities pf. A. | a 96 | 96 | 98 |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 100 | .... | .... |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 91 | .... | .... |
| Minn. Pwr. & Lt., 7% pf. | l102½ | 100 | 103½ |
| Miss. Pwr. & Lt., pf. | k101 | .... | .... |
| Miss. River Pwr., 6% pf. | 93 | 93 | 96 |
| Miss. River Pwr., com. | k 60 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | 101½ | 100 | 105 |
| Mohawk Hudson Pwr., 2nd pf.—$7—no par | k 95 | .... | .... |
| Mohawk Hudson Pwr., com.—no par | k 22½ | 20½ | 28½ |
| Montana Pwr., pf. | m114 | 112½ | 119½ |
| Montana Pwr., com. | 77½ | 69½ | 83½ |
| Montreal Pwr., com. | f 228 | .... | .... |
| Mountain States Pwr., pf. | k 96 | .... | .... |
| Mountain States Pwr., com. | k 20 | .... | .... |
| NASSAU & SUFFOLK, LTG., pf. | 96 | 93 | 97 |
| National Carbon, pf. | m127½ | 125 | 128 |
| National Elec. Pwr., pf. | 92 | 93 | 95 |
| National Electric Pwr-A | m 21½ | 19½ | 26 |
| Nat.-Lt., Ht. & Pwr., com.—no par. | 24 | 22 | 25 |
| National Lt., Ht. & Pwr., 5% pf. | 72 | 71 | 73 |
| National Pwr. & Lt., pf., $7—no par. | k 99½ | .... | .... |
| National Pwr. & Lt., com.—no par. | k 19½ | 16½ | 38½ |
| National Pub. Serv., 7% pf. | 90½ | 90 | 94 |
| National Pub. Serv., pfc. pf. | 95½ | 96 | 97½ |
| National Pub. Serv., A com.—no par | k 19½ | 15½ | 24 |
| National Pub. Serv., B com.—no par | 12½ | 10 | 12½ |
| Nebraska Pwr., 7% pf. | l105 | 103 | 105½ |
| Nevada-Calif. Elec., com. | k 27 | 18½ | 42 |
| New Brunswick Pwr., pf. | 35 | 30 | 40 |
| New England Pub. Serv., pr. ln. pf. | 98 | 98 | 99½ |
| New England Pub. Serv., pf. | 88 | 95½ | 97 |
| N. J. Pwr. & Lt., 7% pf. | 105 | 104 | 108 |
| New Orleans Pub. Serv., 7% pf. | 101 | 100 | 102 |
| N.Y. & Queens Elec. Lt. & Pwr., 5% pf | 88 | 89 | 90 |
| N. Y. Central Elec., 7% pf. | 96 | 98 | 100 |
| Newport News & Hampton Ry., Gas & Elec., com. | 110 | 108 | 112 |
| Newport News & Hampton Ry., Gas & Elec., pf. | 110 | 109 | 114 |
| Niagara Falls Pwr., 7% pf.—25 | k 28½ | 27½ | 28½ |
| Niagara, Lock. & Ont. Pwr., 7% pf. | 108 | 110 | 111½ |
| Niagara, Lock. & Ont. Pwr., com.—no par | m 60½ | n 60 | n 73 |
| No. Amer., 6% pf.—50. | k 50½ | 49 | 50½ |
| No. Amer., com.—10. | k 50 | 42 | 67 |
| No. Amer. Edison pf.—no par. | 93 | 93 | 95 |
| No. Amer., Lt. & Pwr., pf. | 95 | 88 | 90 |
| No. American Utilities, pf., full pd. | m 94½ | 89 | 96 |
| No. American Utilities, pf., 25% pd. | m 19 | 18 | 27 |
| N.C. Pub. Serv., pf.—$7—no par. | k 90 | .... | .... |
| Northeastern Pwr., com. | k 19½ | 17½ | 36½ |
| No. Indiana Gas & Elec., pf. A. | 97 | 98 | 100 |
| No. N. Y. Utilities, 7% pf. | k102½ | .... | .... |
| No. Ohio Pwr., com.—no par. | k 14 | 11 | 26½ |
| No. Ohio Trac. & Lt., 6% pf. | 75 | 78 | 81 |
| No. Ohio Trac. & Lt., 7% pf. | 85 | 88 | 91 |
| No. Ont. Lt. & Pwr., pf. | k 78 | .... | .... |
| No. Ont. Lt. & Pwr., com. | 72 | 45 | 70 |
| No. States Pwr., 7% pf. | k101½ | 99½ | 102½ |
| No. States Pwr. com. | k100½ | 97 | 136½ |
| No. Texas Elec., 6% pf. | k 44 | .... | .... |
| No. Texas Elec., com. | k 19 | .... | .... |
| OHIO BRASS, com. B—no par. | 74 | 70 | 79 |
| Ohio Brass, pf. | 100 | 98 | 101 |
| Ohio Gas & Elec., 7% pf. | 92 | 92 | 95 |
| Ohio Pwr., 6% pf. | 94 | 93 | 95 |
| Ohio Pub. Serv., 6% pf. | 90 | 90 | 93 |
| Ohio Pub. Serv., 7% pf. | 99 | 98½ | 100 |
| Ohio River Edison, pf. | 99 | 99½ | 101½ |
| Oklahoma Gas & Elec., pf. | k 95 | .... | .... |
| PACIFIC GAS & ELEC., 6% pf. | k 97½ | .... | .... |
| Pacific Gas & Elec. com. | k123½ | 118 | 132½ |
| Pacific Pwr. & Lt., 7% pf. | 99 | 98 | 101½ |
| Parr Shoals Pwr., 6% pf. | 92 | .... | .... |
| Penn Central Lt. & Pwr., pf.—no par | c 72 | 71 | 91 |
| Penn-Ohio Edison, 7% pf. | 94 | 95½ | 97½ |
| Penn-Ohio Elec., 7% pf. | 96 | 93 | 96 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, June 1. *l*Bid, low, high, Wednesday, June 2. *m*Latest quotations available. *n*1925

# Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Saturday May 29 | Low 1926 | High 1926 |
|---|---|---|---|
| **STOCKS—Continued** | | | |
| Penn-Ohio Pwr. & Lt., 7% pf. | 96 | 94 | 97 |
| Penn-Ohio Pwr. & Lt., 8% pf. | 106 | 100 | 106 |
| Penn Pwr. & Lt.—$7—no par | *l*106½ | 103 | 106½ |
| Penn Pub. Serv., 7% pf. | 98 | 96 | 100 |
| Penn Pub. Serv., 6% pf. | 85 | 85 | 90 |
| Penn Wtr. & Pwr., com. | 140 | 150 | 165 |
| Phila. Co., 6% pf.—50. | *k* 50 | 47½ | 50½ |
| Phila. Co., com.—50. | *k* 73½ | 59½ | 76½ |
| Phila. Elec., com.—25. | *c* 46½ | 41½ | 67½ |
| Pittsburgh Utilities, pf.—10. | 20½ | 14½ | 20½ |
| Portland Elec. Pwr., 7% pf. | 98 | 97 | 98 |
| Portland Elec. Pwr., 6% pf. | 75 | 71 | 75½ |
| Portland Elec. Pwr., 6% 2d pf. | 71 | 71 | 75 |
| Portland Elec. Pwr., com. | *k* 36 | .... | .... |
| Potomac Elec. Pwr., pf. | *m*106 | .... | .... |
| Pwr. Corp. of N.Y., com—no par. | *m* 79 | 77½ | 90½ |
| Pwr. Sec., pf.—no par. | *k* 15 | .... | .... |
| Pwr. Sec., com.—no par. | *k* 5 | .... | .... |
| Pub. Serv. of N. J., 7% pf. | *k*106½ | 103½ | 108½ |
| Pub. Serv. of N. J., 8% pf. | 120½ | 115 | 120½ |
| Pub. Serv. of N. J., com.—no par. | *k* 80½ | 72 | 92½ |
| Pub. Serv. of No. Ill., 6% pf. | *a*103 | 100½ | 103 |
| Public Serv. of No. Ill., 7% pf. | *c* 114 | 112 | 116½ |
| Pub. Serv. of No. Ill., com.—no par | *a*133 | 128½ | 137 |
| Pub. Serv. of No. Ill., com. | *a*131 | 128½ | 131½ |
| Pub. Serv. of Okla., 7% pf. | 95 | 92 | 95 |
| Pub. Serv. Elec. & Gas, 6% pf. | *k*100½ | 97 | 101½ |
| Public Service Elec. Pwr., pf. | 112 | 106 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | *k*104 | .... | .... |
| Puget Sound Pwr. & Lt., 6% pf. | *k* 83 | .... | .... |
| Puget Sound Pwr. & Lt., com. | *k* 39½ | 39½ | 66½ |
| RADIO CORP. OF AM., pf.—50. | 47½ | 44½ | 47½ |
| Radio Corp. of Amer., com.—no par. | *k* 45½ | 32 | 46½ |
| Republic Ry. & Lt., pf. | *k*104 | .... | .... |
| Republic Ry. & Lt., com. | *k* 84 | .... | .... |
| Rochester Gas & Elec., 5% pf. | 95 | 80 | 98 |
| Rochester Gas & Elec., 6% pf. | 101 | 100 | 102 |
| Rochester Gas & Elec., 7% pf. | 105 | 105 | 107 |
| SAN JOAQUIN LT. & PWR., 7% pf | 97 | 97½ | 98½ |
| St. Joseph Ry., Lt., Ht. & Pwr., pf. | 65 | 60 | 65 |
| Servel Corp., Class A | *k* 22½ | 15½ | 30½ |
| Servel Corp., Class B—no par. | *m* 40 | .... | .... |
| Sierra Pacific Elec., com. | *k* 25 | .... | .... |
| Sioux City Gas & Elec., 7% pf. | 97 | 96 | 98 |
| S. E. Pwr. & Lt., pf.—$7—no par. | 100 | 97 | 100 |
| Southeastern Pwr. & Lt., ptc. pf. | *k* 28½ | 60 | 67½ |
| S. E. Pwr. & Lt., com.—no par. | *k* 20½ | 20 | 46½ |
| So. Calif. Edison, 8% pf. | 130 | 135 | 140 |
| So. Calif. Edison, 7% pf. | *k*110 | .... | .... |
| So. Calif. Edison, 6% pf. | *k* 99 | .... | .... |
| So. Calif. Edison, com. | *k* 32 | 31 | 32 |
| Southern Cities Utilities, 7% pf. | *k* 85 | .... | .... |
| Southern Cities Utilities, com. | *k* 40 | 27 | 49 |
| Southwestern Lt. & Pwr., A | *k* 60 | .... | .... |
| Southwestern Lt. & Pwr., B | *k* 45 | .... | .... |
| Southwestern Lt. & Pwr. $6 pf. | *k* 81 | .... | .... |
| Southwestern Pwr. & Lt., 7% pf. | *k*101 | .... | .... |
| Springfield (Mo.) Ry. & Lt., 7% pf. | 95 | .... | .... |
| Standard Gas & Elec., 8% pf. | *k* 55 | 53½ | 57½ |
| Standard Gas & Elec., 7% pf. | *k*100 | .... | .... |
| Standard Gas & Elec., com —no par | *k* 53½ | 51 | 69 |
| Standard Pwr. & Lt., 7% pf. | *k* 91½ | .... | .... |
| Staten Island Edison, pf.—$6—no par | 93 | 93 | 95 |
| Superheater, com.—no par. | *k*138 | .... | .... |
| Syracuse Lighting, 7% pf. | 102 | 105 | 107 |
| Syracuse Lighting, 8% pf. | 115 | .... | .... |
| Syracuse Lighting, com. | 290 | 260 | 315 |
| TAMPA ELEC., com. | *m*275 | 270 | 315 |
| Tampa Elec., com., new | *k* 50 | .... | .... |
| Tenn. Elec. Pwr., 6% pf. | *k* 85 | .... | .... |
| Tenn. Elec. Pwr., 7% pf. | *k*100 | .... | .... |
| Terre Haute, Ind. & East Trac., pf. | 20 | 23 | 37 |
| Terre Haute, Ind. & East. Trac., com | 3 | 3 | 5 |
| Tex. Pwr. & Lt., 7% pf. | *l*104½ | 102 | 105 |
| Tide Water Pwr., 8% pf. | *k*101 | .... | .... |
| Timken Roller Bearing, com—no par | *k* 50½ | 44½ | 56½ |
| Toledo Edison, 8% pf. | 113 | 112 | 114 |
| Toledo Edison, 7% pf. | 102½ | 101 | 103 |
| Toledo Edison, com. | 100 | .... | .... |
| Tri-City Ry. & Lt., 6% pf. | 89 | 87½ | 89 |
| UNITED GAS & ELEC., 6% pf. | 94 | 94 | 97 |
| United Gas & Elec., com.—no par. | *m*57 | 56 | 66 |
| United Gas & Elec. (N.J.), 5% pf. | 70 | 70 | 75 |
| United Gas Impr.—50. | *c*102½ | 84½ | 144½ |
| United Lt. & Pwr., pf.—$4—no par. | 48 | .... | 51 |
| United L. & P. pf.—$6.50—no par. | 86 | 81 | 91 |
| United Lt. & Pwr., com. A.—no par, new | *k* 14½ | 12½ | 28 |
| United Lt. & Pwr., com., B—no par | *m* 60 | 140 | 165 |
| Utah Pwr. & Lt., 7% pf. | *l*102½ | 99 | 103½ |
| Utica Gas & Elec., 7% pf. | 104½ | 103 | 105 |
| Utica Gas & Elec., com. | 200 | .... | .... |
| Utilities Pwr., & Lt., 7% pf. | *k* 33 | .... | .... |
| Utilities Pwr. & Lt., com. A | *k* 31 | 28½ | 37 |
| Utilities Pwr. & Lt., com. B—no par. | *k* 15 | 14 | 18½ |
| VERMONT HYDRO - ELEC., 7% pf. | 94 | 95 | 96 |
| Virginia Elec. & Pwr., 7% pf. | 103½ | 101 | 103½ |
| Virginian Pwr., 7% pf. | 108 | 102 | 104 |
| Virginian Pwr., com. | 70 | .... | .... |
| WAGNER ELEC., pf. | *b* 68 | 65½ | 85 |
| Wagner Elec., com.—no par. | *b* 21 | 20 | 34½ |
| Washington Ry. & Elec., com. | 175 | .... | .... |
| Washington Ry. & Elec., pf. | *m* 89½ | .... | .... |
| Washington Wtr. Pwr., com. | 126 | 130 | 134 |
| West Mo. Pwr., 7% pf. | *k* 91 | .... | .... |
| West Penn., 7% pf. temp. ctfs. | *m*100 | 95½ | 101 |
| West Penn, com. | *m*125 | 118 | 130 |
| West Penn Elec., pf. | 98½ | 95½ | 100½ |
| West Penn Elec., Class A | *k* 93 | 88½ | 97 |
| West Penn Pwr., pf. | 110 | 108 | 112 |
| West Va. Lt., Ht. & Pwr., 7% pf. | 95 | 95 | 98 |
| West Va. Utilities, 7% pf.—50. | 42 | 43 | 45 |
| Western Pwr., 7% pf. | *k* 96½ | .... | .... |
| Western States Gas & Elec., 7% pf. | *k* 90 | .... | .... |
| Western States Gas & Elec., com. | *k* 17 | .... | .... |
| Westinghouse El. & Mfg., com—50. | *k* 67½ | 65 | 79½ |
| Weston Elec. Instrument, Class. A. | 30 | 27½ | 31½ |
| Weston Elec. Instrument, com. | 15½ | 13½ | 19 |
| Wheeling Elec., pf. | 90 | 91 | 93½ |
| Wis. Pwr., Lt. & Ht., 7% pf. | 90 | 85 | 90 |
| Worthington Pump, pf. A | *k* 73 | 68 | 80 |
| Worthington Pump, pf. B | *k* 56 | 53 | 65 |
| Worthington Pump, com. | *k* 28½ | 20½ | 44½ |
| YADKIN RIVER PWR., 7% pf | *l*105 | 102 | 105 |
| Yale & Towne, com.—25. | *k* 67 | 60½ | 66½ |
| **BONDS** | | | |
| ABITIBI PWR. & PAPER | 6s | 1940 *k*101½ | .... .... |
| Adir. Elec. Pwr. | 5s | 1962 *k*101½ | .... .... |
| Adir. Pwr. & Lt. | 6s | 1950 *k*106½ | .... .... |
| Adir. Pwr. & Lt. | 5s | 1930 97½ | 97 99 |
| Ala. Pwr. | 5s | 1946 101 | 99 101 |
| Ala. Pwr. | 5s | 1951 99½ | 97 100½ |
| Ala. Pwr. | 6s | 1951 104½ | 104½ 105½ |
| Ala. Trac., Lt. & Pwr. | 5s | 1962 *m*111 | 112 124 |
| Aluminum Co. of Amer. | 7s | 1933 *k*106½ | 106½ 107½ |
| Amer. Gas & Elec. | 5s | 2007 99 | 92 99 |
| Amer. Gas & Elec. | 6s | 2014 *k*101½ | 98 101½ |
| Amer. Pwr. & Lt. | 6s | 2016 *k* 99 | 96 99½ |
| Amer. Pub. Serv. | 6s | 1942 100½ | 98½ 100½ |
| Amer. Wtr. Wks. & Elec. | 5s | 1934 *k* 97½ | .... .... |
| Amer. Wtr. Wks. & Elec. | 6s | 1975 *k* 94½ | 92½ 94½ |
| Anaconda Copper | 6s | 1929 102½ | 102½ 103½ |
| Anaconda Copper | 6s | 1953 *k*103½ | .... .... |
| Anaconda Copper | 7s | 1938 *k*106 | .... .... |
| Appalachian Pwr. | 5s | 1941 *k*100½ | .... .... |
| Appalachian Pwr. | 6s | 2024 96 | 93 96 |
| Appalachian Pwr. | 7s | 1936 107½ | 105 108 |
| Arizona Pwr. | 6s | 1933 100½ | 99½ 101 |
| Arizona Pwr. | 6s | 1947 96½ | 95½ 97 |
| Ark. Central Pwr. | 6s | 1948 103 | 102 103½ |
| Ark. Lt. & Pwr. | 6s | 1945 *k*103½ | .... .... |
| Ark. Lt. & Pwr. | 6s | 1954 *k*100½ | .... .... |
| Assoc. Gas & Elec. | 6s | 1965 95½ | .... .... |
| Assoc. Gas & Elec. | 6½s | 1954 *k*102 | .... .... |
| BERLIN CITY ELEC. | 6½s | 1928 98½ | 98 100 |
| Berlin City Elec. | 6½s | 1929 97½ | 97 98½ |
| Binghamton Lt., Ht. & Pwr. | 5s | 1946 *k* 99½ | .... .... |
| Birmingham Elec. | 6s | 1954 103½ | 102½ 104 |
| Birmingham Ry., L. & P. | 4½s | 1954 92 | 88 92½ |
| Broad River Power | 5s | 1954 90½ | 91 92 |
| Broad River Pwr. | 6½s | 1934 100½ | 100 102 |
| Brooklyn Edison | 5s | 1949 104½ | 103 105½ |
| Brooklyn Edison | 6s | 1930 104½ | 103½ 106½ |
| Buffalo Gen. Elec. 1st | 5s | 1939 102½ | 101½ 102½ |
| Buffalo G. E., 1st & Ref. | 5s | 1939 102 | 101½ 102½ |
| Buffalo G. E. | 5s | 1956 103½ | 99½ 103½ |
| Burlington Ry. & Lt. | 5s | 1932 96½ | 96 97½ |
| Butte Elec. & Pwr. | 5s | 1951 *k*101 | .... .... |
| CALIF. ELEC. GEN. | 5s | 1948 *k*101½ | .... .... |
| Calif. Gas & Elec. | 5s | 1937 101½ | .... .... |
| Calumet Gas & Elec. | 5½s | 1960 101½ | 97½ 101½ |
| Canadian Lt. & Pwr. | 5s | 1949 61 | 56 64 |
| Canton Elec. | 5s | 1937 100½ | 100 101 |
| Carolina Pwr. & Lt. | 5s | 1938 105 | 100½ 105 |
| Carolina Pwr. & Lt. | 5s | 1956 *k* 99½ | 97½ 99½ |
| Carolina Pwr. & Lt. | 6s | 1953 *m*104½ | 104½ 105½ |
| Cedar Rap. Mfg. & Pwr. | 5s | 1953 100½ | 99½ 101½ |
| Central Ark. Ry. & Lt. | 5s | 1928 99½ | 99 100½ |
| Central Ga. Pwr. | 5s | 1938 96½ | 95 97 |
| Central Ill. Lt. | 5s | 1943 *k*101 | .... .... |
| Central Ill. Pub. Serv. | 5s | 1952 95½ | 92 94½ |
| Central Ill. Pub. Serv. | 5½s | 1950 99½ | 96 99½ |
| Central Ill. Pub. Serv. | 6s | 1944 101½ | 99 101½ |
| Central Ind. Pwr. | 6s | 1947 100 | 98 100 |
| Central Ia. Pwr. & Lt. | 6s | 1944 100½ | 99½ 101 |
| Central Maine Power | 5s | 1939 99½ | 98½ 100 |
| Central N. Y. Gas & El. | 5s | 1941 *k* 98 | .... .... |
| Central Pwr. & Lt. | 6s | 1946 *m*101½ | .... .... |
| Central Pwr. & Lt. | 6½s | 1952 *k*105 | .... .... |
| Central States Elec. | 6s | 1945 94½ | 91 98½ |
| Chattanooga Ry. & Lt. | 5s | 1956 89½ | 81 90 |
| Cincinnati Gas & Elec. | 5s | 1956 102½ | 102 103½ |
| Cincinnati Gas & Elec. | 5½s | 1961 *k*105 | .... .... |
| Cities Service | 6s | 1966 *k* 93 | 91½ 94 |
| Cities Service | 7aB | 1966 *k*189 | 178 189 |
| Cities Service | 7aC | 1966 *m*129½ | 125½ 131 |
| Cities Service | 7aD | 1966 *m*104½ | 101½ 104½ |
| Cities Service | 7aE | 1966 *m*104½ | 109 109½ |
| Cities Service Pwr. & Lt. | 6s | 1944 *k* 95½ | .... .... |
| City L. & T., Sedalia, Mo | 5s | 1952 84½ | 83 85½ |
| Cleveland Elec. Illum. | 5s | 1939 103½ | 102½ 104 |
| Cleveland Elec. Illum. | 5s | 1954 103½ | 102½ 104½ |
| Cleveland Elec. Illum. | 7s | 1941 111 | 110 112 |
| Colorado Pwr. | 5s | 1953 98½ | 95½ 99 |
| Columbia Gas & Elec. | 5s | 1927 *k*101 | .... .... |
| Columbia Ry., Gas & El. | 5s | 1936 94 | 92½ 95 |
| Columbus, Dela. & Marion Elec. | 5s | 1937 87 | 83½ 86 |
| Columbus, Dela. & Marion Elec. | 6s | 1937 94½ | 93½ 96 |
| Columbus Elec. & Pwr. | 6s | 1947 *k*103 | .... .... |
| Columbus Ry., Pwr. & Lt. | 5s | 1940 *k* 98½ | .... .... |
| Columbus Ry., Pwr. & Lt. | 6s | 1941 *k*104 | .... .... |
| Commonwealth Edison | 5s | 1943 *k*102½ | .... .... |
| Commonwealth Edison | 5s | 1953 102 | 99½ 102½ |
| Commonwealth Edison | 5s | 1954 *k*102 | .... .... |
| Commonwealth Pwr. | 5s | 1939 *k* 93 | .... .... |
| Commonwealth Pwr. | 6s | 1972 *k* 97½ | .... .... |
| Commonwealth Pwr. | 6s | 1947 *k*104 | .... .... |
| Community Pwr. & Lt. | 6s | 1950 100½ | 98 100½ |
| Conn. Ry. & Ltg | 4½s | 1951 90½ | 90 92 |
| Consol. Cities Lt., Pwr. & Trac. | 5s | 1962 81½ | 80 82½ |
| Consol. Elec. | 5s | 1955 98 | 98 99 |
| Consol. Gas of N. Y. | 5½s | 1945 *k*105½ | .... .... |
| Con. Gas. Elec. Lt. & Pwr. of Balti. | 4½s | 1935 *e* 98½ | 95½ 98½ |
| Con. Gas. Elec. Lt. & Pwr. of Balti. (notes) | 6s | 1949 *e*107½ | 105½ 107½ |
| Con. Gas. Elec. Lt. & Pwr. of Balti. | 5s | 1965 *e*102½ | 100½ 102½ |
| Con. Gas. Elec. Lt. & Pwr. of Balti. (notes) | 5½s | 1952 106½ | 105 106½ |
| Con. Gas. Elec. Lt. & Pwr. of Balti. (notes) | 6½s | 1951 *m*109½ | 109 109½ |
| Consumers Elec. L. & P. | 5s | 1936 *k* 98½ | .... .... |
| Consumers Pwr. | 5s | 1936 *k*101½ | .... .... |
| Consumers Pwr. | 5s | 1952 *k*102½ | .... .... |
| Consumers Pwr. | 5½s | 1954 *k*104½ | .... .... |
| Continental Gas & Elec. | 5s | 1927 *k*100 | .... .... |
| Continental Gas & Elec. | 6s | 1947 *k*101½ | .... .... |
| Continental Gas & Elec. | 6½s | 1964 *k*100 | .... .... |
| Continental Gas & Elec. | 7s | 1954 *k*106 | .... .... |
| Cumberland Cty. Pw. & Lt. | 5s | 1942 99½ | 94 97½ |
| DALLAS PWR. & LT. | 6s | 1949 104½ | 104 105 |
| Dayton Ltg. | 5s | 1937 100½ | 100 101 |
| Dayton Pwr. & Lt. | 5s | 1941 102½ | 100 103 |
| Defiance Gas & Elec. | 5s | 1942 98½ | 98 99 |
| Denver Gas & Elec. | 5s | 1949 99 | 98 100 |
| Denver Gas & Elec. Lt. | 5s | 1951 *k* 98 | .... .... |
| Des Moines Elec. | 5s | 1938 101 | 99 101 |
| Detroit Edison | 5s | 1933 *k*102½ | .... .... |
| Detroit Edison | 5s | 1940 *k*103½ | .... .... |
| Detroit Edison | 5s | 1949 *k*103½ | .... .... |
| Detroit Edison | 5s | 1955 103½ | 100½ 104 |
| Detroit Edison | 6s | 1932 *m*124½ | 124½ 135 |
| Detroit Edison | 6s | 1940 *k*108½ | .... .... |
| Detroit Edison | 7s | 1928 *m*131½ | 124½ 134 |
| Detroit Edison | 7s | 1929 *m*131 | 124½ 131 |
| Detroit Edison | 7s | 1930 128½ | 124½ 138½ |
| Dominion Pwr. & Trans | 5s | 1932 96 | 95 97 |
| Driver-Harris | 8s | 1931 97½ | 95 98½ |
| Dubuque Elec. | 6s | 1942 102½ | 102 103½ |
| Duke-Price Pwr. | 6s | 1949 *m*107 | 102 106 |
| Duke Price Pwr. | 6s | 1966 *k*102½ | 100½ 102½ |
| Duquesne Lt. | 6s | 1949 *k*106½ | .... .... |
| Duquesne Lt. | 5½s | 1949 105½ | 105 106½ |
| Durham Pub. Serv. | 7s | 1949 101 | 99 101½ |
| EAST PENN. ELEC. | 6s | 1953 104½ | 105 106 |
| East. N. J. Pwr. | 6s | 1949 101½ | 99 101½ |
| East Oregon Lt. & Pwr. | 6s | 1929 100 | 100 101 |
| East. Tex. Elec. | 5s | 1942 *k* 97 | .... .... |
| Economy Lt. & Pwr. | 5s | 1956 99½ | 99 100½ |
| Edison Elec. Illum. of Boston (notes) | 4½s | 1928 99½ | 99½ 100½ |
| Edison Elec. Illum. of Bklyn. | 4s | 1939 94½ | 93 99½ |
| Edison El. Illum. (N.Y.) | 5s | 1995 105½ | 103 108½ |
| El Paso Elec. | 5s | 1932 *m*102 | .... .... |
| El Paso Elec. | 5s | 1950 99 | 95 99½ |
| El. Pwr. Corp. (Germany) | 6½s | 1950 *k* 87½ | .... .... |
| Elec. Refrigeration | 6s | 1936 103½ | 100½ 107 |
| Elmira Wtr., Lt. & R.R. | 5s | 1956 98 | 96 98½ |
| Empire Dist. Elec. | 5s | 1949 94½ | 92 94½ |
| Erie Ltg. | 5s | 1967 100 | 99 100½ |
| Evansville G. & El. Lt. | 5s | 1932 99 | 99 100 |
| FEDERAL LT. & TRAC. | 5s | 1942 *k* 96½ | .... .... |
| Federal Lt. & Trac. | 6s | 1942 *k*103½ | .... .... |
| Federal Lt. & Trac. | 6s | 1954 95½ | 93 96 |
| Florida Power & Light | 5s | 1954 *k* 95½ | 91½ 96½ |
| Florida Publ. Service | 6s | 1955 97 | 97 99 |
| Florida Public Service | 6½s | 1949 99½ | 99 103 |
| Ft. Smith Lt. & Trac. | 5s | 1936 *k* 81 | .... .... |
| Ft. Worth Pwr. & Lt. | 5s | 1931 100½ | 99 100½ |
| GALVESTON ELEC. | 5s | 1940 87 | 89 92 |
| General Elec. | 3½s | 1942 90½ | 87 90 |
| Georgia Carolina Pwr. | 5s | 1952 26½ | 87 100½ |
| Ga. Lt., Pwr & Rys. | 5s | 1941 89 | 86½ 92 |
| Ga. Ry. & Elec. | 5s | 1932 99½ | 89 100½ |
| Ga. Ry. & Elec. | 5s | 1949 96½ | 94½ 97 |
| Ga. Ry. & Pwr. | 5s | 1954 98 | 96 99 |
| Ga. Ry. & Pwr. | 6s | 1947 *k*104 | .... .... |
| Ga. Ry. & Pwr. | 7s | 1941 *k*105 | .... .... |
| German Gen. Elec. | 6½s | 1940 *k*100½ | .... .... |
| German Gen. Elec. | 7s | 1945 *k* 99½ | .... .... |
| Great Cons. Elec. Pwr. (Japan) | 6½ | 1950 *k* 85½ | .... .... |
| Great Cons. Elec. Pwr. (Japan) | 7s | 1944 *k* 92½ | .... .... |
| Great Falls Pwr. | 5s | 1940 *k*103½ | 101½ 104½ |
| Great Northern Pwr. | 5s | 1935 *k* 99½ | 98½ 100½ |
| Great Western Pwr. | 5s | 1946 *k* 99½ | .... .... |
| Great Western Pwr. | 5½s | 1955 100½ | 99 101 |
| Great Western Pwr. | 6s | 1949 102½ | 102 103½ |
| Great Western Pwr. | 6s | 1952 *k*103½ | .... .... |
| HAMBURG ELEC. | 7s | 1935 *k* 97½ | 94 97½ |
| Havana Elec. R., Lt. & P | 5s | 1954 96½ | 92½ 96½ |
| Holtwood Pwr. | 6s | 1954 104½ | 100 104½ |
| Houston Ltg. & Pwr. | 5s | 1931 100½ | 99 101 |
| Houston Ltg. & Pwr. | 5s | 1953 98½ | 90½ 98½ |
| Houston Ltg. & Pwr. | 5½s | 1954 101½ | 99½ 102½ |
| Hydraulic Pwr. | 5s | 1951 102½ | 101½ 102 |
| Hydraulic Pwr. | 5s | 1950 102½ | 101½ 103 |
| IDAHO PWR. | 5s | 1947 99½ | 96 99½ |
| Ill. Elec. Pwr. | 6s | 1943 103½ | 102 103½ |
| Ill. Pwr. | 5s | 1933 *k* 96 | .... .... |
| Ill. Pwr. | 6s | 1944 *k* 99 | .... .... |
| Ill. Pwr. & Lt. | 5½s | 1954 98½ | 97½ 99 |
| Ill. Pwr. & Lt. | 6s | 1953 102½ | 100½ 102½ |
| Ill. Pwr. & Lt. | 7s | 1953 102½ | 102 103½ |
| Ind. Elec. | 6s | 1947 99 | 96½ 99½ |
| Ind. Gen. Serv. | 5s | 1948 99 | 96½ 99½ |
| Ind. Lighting | 4s | 1958 83½ | 82½ 84 |
| Indiana & Mich. Elec. | 5s | 1955 98½ | 96 98½ |
| Indiana & Mich. Elec. | 5s | 1957 100 | 97½ 100½ |
| Ind. Service | 5s | 1950 93½ | 91½ 94 |
| Ind. Service | 6s | 2020 88 | 83 89 |
| Ingersoll-Rand | 5s | 1935 100 | .... .... |
| International Pwr. Sec. | 6½s | 1955 *l* 90½ | .... .... |
| Interstate Elec. | 6s | 1933 94 | 94 98½ |
| Interstate Pwr. | 6s | 1944 *k* 99 | .... .... |
| Interstate Pwr. | 7s | 1934 *k*100½ | .... .... |
| Interstate Pub. Serv. | 6s | 1948 99½ | 98 99½ |
| Iowa Ry. & Lt. | 5s | 1932 99 | 97½ 100 |
| Iowa Southern Utilities | 5½s | 1950 94 | 94 96 |
| JERSEY CENT. PWR. & LT. | 5½s | 1945 96½ | 95 98 |
| KANSAS CITY PWR. & LT. | 5s | 1952 *k*103½ | .... .... |
| Kansas Elec. Pwr. | 6s | 1937 *k*101½ | .... .... |
| Kansas Elec. Pwr. | 6s | 1943 102½ | 99½ 102½ |
| Kansas Gas & Elec. | 6s | 1952 104½ | 101½ 106 |
| Kansas Gas & Elec. | 6s | 2022 95 | 92½ 93½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; (Pittsburgh; *j*Washington. *k*Bid, low, high. Tuesday, June 1. *l*Bid, low, high, Wednesday, June 2. *m*Latest quotations available. *n*1925.

## Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | | Bid Price Saturday May 29 | Low 1926 | High 1926 |
|---|---|---|---|---|
| **BONDS (Continued)** | | | | |
| Kentucky Hydro Elec.... | 6s | 1949 | 102 | 99½ | 102½ |
| Kentucky Utilities..... | 6s | 1949 | 102½ | 99 | 102½ |
| Kings Cty. Elec. L. & P.. | 5s | 1937 | 103½ | 102 | 103 |
| Kings Cty. Elec. L. & P.. | 6s | 1997 | 123½ | 120½ | 123½ |
| Kings County Ltg..... | 5s | 1954 | 100½ | 98½ | 100½ |
| Kings County Ltg..... | 6½s | 1954 | 109 | 106 | 110 |
| Knoxville Ry. & Lt..... | 5s | 1946 | 97½ | 95½ | 98 |
| LACLEDE GAS LT..... | 5s | 1934 | *k*101 | .... | .... |
| Laclede Gas Lt..... | 5½s | 1953 | *k*104 | .... | .... |
| Laurentian Pwr..... | 6s | 1936 | 100½ | 100 | 101 |
| Laurentide Pwr..... | 5s | 1946 | 100½ | 100 | 102 |
| Lehigh Pwr. Sec..... | 6s | 2026 | *k* 95 | 93 | 95½ |
| Lincoln Gas & Elec..... | 5s | 1941 | 94½ | 92½ | 94½ |
| Long Island Ltg..... | 5s | 1936 | 100½ | 99 | 100½ |
| Long Island Ltg..... | 6s | 1954 | *k*102 | 99½ | 102 |
| Long Island Ltg..... | 6s | 1948 | 107½ | 104½ | 108 |
| Los Angeles Gas & Elec.. | 5s | 1939 | *k*100 | .... | .... |
| Los Angeles Gas & Elec.. | 5½s | 1943 | 103½ | 99 | 103½ |
| Los Angeles Gas & Elec.. | 5½s | 1947 | *k*103 | .... | .... |
| Los Angeles Gas & Elec.. | 5½s | 1949 | 103½ | 99 | 103½ |
| Los Angeles Gas & Elec.. | 6s | 1942 | 106½ | 102½ | 107½ |
| Louisiana Pwr..... | 6s | 1944 | 101 | 98½ | 101½ |
| Louisville Gas & Electric. | 6s | 1937 | 101 | 100 | 102 |
| Louisville Gas & Elec.... | 5s | 1952 | *k*100 | .... | .... |
| Louisville Gas & Elec.... | 5½s | 1954 | 104 | 102 | 104½ |
| Lower Austrian Hydro El. | 6½s | 1944 | *k* 83 | .... | .... |
| Luzerne Cty. Gas & El... | 5s | 1948 | 99½ | 97½ | 99½ |
| Luzerne Cty. Gas & El... | 7s | 1944 | 105 | 103½ | 105½ |
| Luzerne Cty. Gas & El... | 6s | 1954 | 104½ | 102 | 104 |
| MADISON RIV. PWR.. | 5s | 1935 | 100½ | 100 | 101 |
| Manila Elec..... | 7s | 1942 | 114½ | 102 | 115½ |
| Manila Elec. Ry. & Ltg.. | 5s | 1953 | 95 | 89½ | 97 |
| Manitoba Pwr..... | 5½s | 1951 | *k* 97½ | 94½ | 98 |
| Memphis Pwr. & Lt..... | 5s | 1948 | 101 | 99 | 101½ |
| Metropolitan Edison.... | 6s | 1952 | *k*108½ | .... | .... |
| Metropolitan Edison.... | 5s | 1953 | *k*100½ | .... | .... |
| Metropolitan Pwr..... | 6s | 1953 | 105½ | 102½ | 105½ |
| Michigan Lt..... | 5s | 1946 | *k*100½ | .... | .... |
| Michigan No. Pwr..... | 5s | 1941 | 99½ | 97 | 100 |
| Milwaukee El. Ry. & Lt.. | 4½s | 1931 | *k* 98½ | .... | .... |
| Milwaukee El. Ry. & Lt.. | 5s | 1951 | *k* 99½ | .... | .... |
| Milwaukee El. Ry. & Lt.. | 5s | 1961 | *k* 96½ | .... | .... |
| Milwaukee El. Ry. & Lt.. | 6s | 1953 | *k*104½ | .... | .... |
| Minn. Pwr. & Lt..... | 5s | 1955 | 98½ | 95½ | 99 |
| Minn. Pwr. & Lt..... | 6s | 1950 | 105½ | 104 | 106 |
| Miss. Power..... | 5s | 1955 | 93 | 92 | 94 |
| Miss. River Pwr..... | 5s | 1951 | 100½ | 99 | 100½ |
| Miss River Pwr..... | 7s | 1935 | 101½ | 102 | 103 |
| Mo. Edison Elec..... | 5s | 1927 | *m*100½ | 100½ | 100½ |
| Mo. Pwr. & Lt..... | 5½s | 1955 | 97½ | 96 | 98½ |
| Mobile Elec..... | 5s | 1946 | 98½ | 97 | 98½ |
| Monongahela W. Pa. Pub. Service..... | 5½s | 1953 | 96 | 95 | 97½ |
| Montana Pwr..... | 5s | 1943 | *k*101½ | .... | .... |
| Montreal Lt., Ht. & Pwr. | 4½s | 1932 | *k* 98 | .... | .... |
| Montreal Lt., Ht. & Pwr. | 5s | 1933 | 99½ | 99½ | 101 |
| Montreal Pub. Serv..... | 5s | 1942 | *k* 95 | .... | .... |
| Mountain States Pwr.... | 6s | 1938 | 100½ | 98½ | 101 |
| Municipal Service..... | 5s | 1942 | 93 | 92½ | 93½ |
| NASHVILLE RY. & LT. | 5s | 1953 | 98½ | 96½ | 98½ |
| Nashville Ry. & Lt..... | 5s | 1958 | 93 | 90½ | 93 |
| Nassau Lt. & Pwr..... | 5s | 1927 | 99½ | 98½ | 100½ |
| Nassau & Suffolk Ltg.... | 5s | 1945 | 92½ | 89½ | 93 |
| National Elec. Power.... | 6s | 1945 | 92½ | 92½ | 94 |
| National Pwr. & Lt..... | 7s | 1972 | *k*103 | .... | .... |
| National Pub. Serv..... | 6½s | 1955 | 95½ | 94½ | 97 |
| Nebraska Pwr..... | 5s | 1949 | 101 | 99 | 101½ |
| Nebraska Pwr..... | 6s | 2022 | 98½ | 94½ | 99 |
| Nevada-Calif. Elec..... | 6s | 1946 | *k*102 | .... | .... |
| Nevada-Calif. Elec..... | 6s | 1950 | 101½ | 98½ | 102 |
| New Brunswick Pwr..... | 5s | 1937 | *k* 84 | .... | .... |
| New England Pwr..... | 5s | 1951 | 103½ | 100½ | 104½ |
| New Jersey Pwr. & Lt.... | 5s | 1936 | 99 | 96½ | 99 |
| New Orleans Pub. Serv... | 4½s | 1935 | 90 | 87 | 89½ |
| New Orleans Pub.Serv.,A. | 5s | 1952 | *k* 95½ | .... | .... |
| New Orleans Pub. Serv... | 5s | 1955 | 95½ | 90½ | 96½ |
| New Orleans Pub. Serv... | 6s | 1949 | 94 | 90 | 94 |
| N.Y. & Queens El. L.&P.. | 5s | 1930 | 101 | 100½ | 103½ |
| N.Y. & Westchester Ltg.. | 4s | 2004 | 81½ | 79½ | 81½ |
| N.Y. & Westchester Ltg.. | 5s | 1954 | 99½ | 97½ | 98½ |
| New York Edison..... | 6½s | 1941 | *k*117½ | .... | .... |
| New York Edison..... | 5s | 1944 | *k*104½ | .... | .... |
| N.Y. Gas & El. L., H.&P. | 5s | 1948 | *k*105½ | .... | .... |
| N.Y. Gas & El. L., H.&P. | 4s | 1949 | 91½ | 89½ | 92 |
| N.Y. State Gas & Elec... | 5½s | 1962 | 101½ | 100 | 101 |
| Newport News & Hampton Ry., Gas & Elec.... | 5s | 1944 | 90 | 89½ | 92 |
| Niagara Falls Pwr..... | 5s | 1932 | 102 | 100½ | 103 |
| Niagara Falls Pwr..... | 6s | 1932 | 105½ | 104½ | 106½ |
| Niagara Falls Pwr..... | 6s | 1950 | 106 | 105 | 107 |
| Niagara, Lock. & Ont. Pwr. | 5s | 1955 | *k*101½ | .... | .... |
| Niagara, Lock. & Ont. Pwr. | 6s | 1958 | *m*106 | .... | .... |
| Norfolk Ry. & Lt..... | 5s | 1949 | 97 | 94 | 97 |
| No. Amer. Edison..... | 6s | 1952 | *k*104½ | .... | .... |
| No. Amer. Edison..... | 6½s | 1948 | *k*105½ | .... | .... |
| No. Amer. Lt. & Pwr..... | 7s | 1954 | 98½ | 99 | 100½ |
| North Caro. Pub. Serv... | 5s | 1934 | *k* 96 | .... | .... |
| North Caro. Pub. Serv... | 6s | 1955 | 96 | 94½ | 97 |
| North Caro. Pub. Serv... | 6½s | 1954 | 99 | 98 | 100½ |
| North Shore Elec..... | 5s | 1940 | 100½ | 98½ | 101 |
| No. Calif. Pwr..... | 5s | 1948 | *k*101½ | .... | .... |
| No. Ind. Gas & Elec..... | 5s | 1929 | 99½ | 99 | 100 |
| No. Ind. Gas & Elec..... | 6s | 1952 | 104½ | 102½ | 105 |
| Northern N. Y. Utilities.. | 5s | 1955 | 98½ | 95 | 98½ |
| Northern N. Y. Utilities.. | 5½s | 1949 | 100½ | 100 | 101½ |
| No. Ohio Pwr..... | 7s | 1935 | *k* 93 | .... | .... |
| No. Ohio Trac. & Lt..... | 4s | 1933 | 90 | 87 | 91 |
| No. Ohio Trac. & Lt..... | 5s | 1956 | 84½ | 84 | 86 |
| No. Ohio Trac. & Lt..... | 6s | 1926 | *k* 98 | 99 | 100 |
| No. Ohio Trac. & Lt..... | 6s | 1947 | *k* 98 | .... | .... |
| No. States Pwr..... | 6½s | 1933 | *k*110 | 108 | 132 |
| No. States Pwr. (notes).... | 6½s | 1933 | *k*103½ | 102½ | 104 |
| No. States Pwr..... | 6s | 1948 | *k*103½ | .... | .... |
| No. States Pwr..... | 6s | 1941 | *k*105 | .... | .... |
| No. States Pwr..... | 5s | 1941 | 100½ | 97½ | 101 |
| No. Tex. Elec..... | 5s | 1940 | 68 | 72 | 75 |
| Northwestern Elec..... | 6s | 1935 | 102½ | 102 | 103½ |
| Northwestern Pub. Serv.. | 6½s | 1948 | 101½ | 99½ | 102½ |
| Nova Scotia Tr. & Pwr... | 5s | 1946 | 88 | 88 | 90 |
| OHIO PWR..... | 5s | 1952 | *k* 99 | 94 | 99 |
| Ohio Pwr..... | 6s | 1953 | 105½ | 103½ | 104½ |
| Ohio Pwr..... | 6s | 2024 | 98½ | 95½ | 98½ |
| Ohio Pwr..... | 7s | 1951 | 106 | 105½ | 106½ |
| Ohio Pub. Serv..... | 5s | 1954 | 99½ | 92½ | 97 |
| Ohio Pub-Serv..... | 6s | 1953 | 103½ | 101 | 104½ |
| Ohio Pub. Serv..... | 7½s | 1946 | 112½ | 112½ | 113½ |
| Ohio Pub. Serv..... | 7s | 1947 | *k*112 | .... | .... |
| Ohio River Edison..... | 6s | 1948 | *k*104½ | .... | .... |
| Okla. Gas & Elec..... | 5s | 1950 | 95 | 93 | 95½ |
| Okla. Gas & Elec..... | 6s | 1940 | *k* 96 | .... | .... |
| Ontario Pwr. of Niagara Falls..... | 5s | 1943 | *k*100 | .... | .... |
| Ontario Transmission.... | 5s | 1945 | 100½ | 99½ | 101 |
| Ozark Pwr. & Wtr..... | 5s | 1952 | 84 | 77 | 84 |
| PACIFIC COAST PWR.. | 5s | 1940 | 101 | 99 | 101½ |
| Pacific Gas & Elec..... | 5s | 1942 | *k*100½ | .... | .... |
| Pacific Gas & Elec..... | 5½s | 1952 | *k*104½ | .... | .... |
| Pacific Gas & Elec..... | 6s | 1941 | *k*108½ | .... | .... |
| Pacific Lt. & Pwr..... | 5s | 1942 | *k*101½ | .... | .... |
| Pacific Lt. & Pwr..... | 5s | 1951 | 101 | 100 | 101½ |
| Pacific Pwr. & Lt..... | 5s | 1930 | 99½ | 99½ | 101 |
| Pacific Pwr. & Lt..... | 5s | 1953 | *m* 96½ | .... | .... |
| Parr Shoals Pwr..... | 5s | 1952 | 97½ | 95 | 98½ |
| Paterson & Passaic G.&E. | 5s | 1949 | 102 | 100 | 101½ |
| Penn Central Lt. & Pwr... | 5½s | 1975 | 97½ | 94½ | 98 |
| Penn Central Lt. & Pwr... | 6s | 1953 | 104 | 102½ | 105 |
| Penn Edison..... | 5s | 1946 | 99½ | 96½ | 99½ |
| Penn. Elec..... | 6s | 1955 | *m*105 | 92 | 105 |
| Penn. Elec..... | 6½s | 1954 | *m*105 | 97 | 100½ |
| Penn.-Ohio Edison..... | 6s | 1950 | *k*102 | 98½ | 106 |
| Penn Ohio Elec..... | 6½s | 1938 | 105½ | 105 | 107 |
| Penn Ohio Pwr. & Lt..... | 5½s | 1954 | *k*101 | .... | .... |
| Penn Ohio Pwr. & Lt..... | 6s | 1939 | 98 | 97 | 98½ |
| Penn Pwr. & Lt..... | 5s | 1952 | 100 | 97½ | 100 |
| Penn Pwr. & Lt..... | 5s | 1953 | 99½ | 97½ | 99½ |
| Penn Pwr. & Lt..... | 6s | 1953 | 105½ | 105 | 106 |
| Penn Pwr. & Lt..... | 7s | 1951 | 106 | 105½ | 108½ |
| Penn Pub. Serv..... | 5s | 1954 | 98 | 96 | 98½ |
| Penn Pub. Serv..... | 6s | 1947 | 105½ | 103 | 105 |
| Penn Wtr. & Pwr..... | 5s | 1940 | 102½ | 101½ | 102½ |
| Penn Wtr. & Pwr..... | 5½s | 1953 | 104 | 102½ | 103½ |
| Phila. Co..... | 6s | 1944 | *k*105 | .... | .... |
| Phila. Co..... | 5½s | 1938 | *k*100½ | .... | .... |
| Phila. Co..... | 5s | 1951 | 98 | 97½ | 99½ |
| Phila. Co..... | 5s | 1949 | *m*104 | 103½ | 104½ |
| Phila. Elec..... | 5s | 1966 | *c*104½ | 102 | 104½ |
| Phila. Elec..... | 4s | 1966 | *m* 88 | 84 | 88 |
| Phila. Elec..... | 5s | 1960 | *c*103½ | 102 | 103½ |
| Phila. Elec..... | 6s | 1941 | *c*107½ | 107½ | 108½ |
| Phila. Elec..... | 5½s | 1947 | *c*107½ | 103½ | 107½ |
| Phila. Elec..... | 5½s | 1953 | *c*107½ | 103½ | 107½ |
| Phila. Elec. Pwr..... | 5½s | 1972 | *k*102½ | 100½ | 103½ |
| Portland Elec. Pwr..... | 6s | 1947 | *k*101½ | .... | .... |
| Portland Gen. Elec..... | 5s | 1935 | 100½ | 99½ | 102½ |
| Portland Ry., Lt. & Pwr.. | 5s | 1942 | *k* 91 | 88½ | 94½ |
| Portland Ry., Lt. & Pwr.. | 6s | 1947 | *k*100½ | .... | .... |
| Portland Ry., Lt. & Pwr.. | 7½s | 1946 | 106½ | 105½ | 108½ |
| Potomac Edison..... | 6s | 1949 | 106 | 99 | 100½ |
| Potomac Edison..... | 6½s | 1948 | 103½ | 103 | 104 |
| Potomac Elec. Pwr..... | 5s | 1929 | 100 | 99½ | 100½ |
| Potomac Elec. Pwr..... | 5s | 1936 | 99½ | 99½ | 100½ |
| Potomac Elec. Pwr..... | 6s | 1953 | 106½ | .... | .... |
| Potomac Elec. Pwr..... | 7s | 1947 | 106½ | .... | .... |
| Power Corp. of N.Y..... | 6s | 1942 | 101½ | 101 | 101½ |
| Power Corp. of N.Y..... | 6½s | 1942 | 105 | 104 | 105½ |
| Power Securities..... | 6s | 1949 | *k* 79 | .... | .... |
| Pub. Lt. & Pwr..... | 5s | 1945 | 69 | 68 | 73 |
| Pub. Serv. Co. of Colo... | 5½s | 1954 | 97½ | 95 | 96½ |
| Pub. Serv. Co. of Colo... | 6s | 1953 | 101½ | 100 | 101½ |
| Pub. Serv. Co. of Colo... | 7s | 1933 | 101½ | 101½ | 102½ |
| Pub. Serv. Corp. of N.J.. | 5s | 1959 | *m*101 | 104½ | 105 |
| Pub. Serv. Corp. of N.J.. | 6s | 1944 | *k*103½ | .... | .... |
| Pub. Serv. Co. of No. Ill.. | 5s | 1956 | 99 | 99 | 100 |
| Pub. Serv. Co. of No. Ill.. | 5½s | 1962 | 100 | 103½ | 106 |
| Pub. Serv. Co. of No. Ill.. | 5½s | 1964 | 100 | 103½ | 106 |
| Pub. Serv. Co. of Okla... | 6s | 1949 | 102½ | 98½ | 102½ |
| Pub. Serv. Elec. & Gas... | 5½s | 1959 | *k*105½ | .... | .... |
| Pub. Serv. Elec. & Gas... | 5½s | 1964 | *k*105 | .... | .... |
| Pub. Util. Evansville, (Ind.) | 6s | 1929 | *k*100½ | .... | .... |
| Puget Sound Pwr..... | 5s | 1933 | 100½ | 99 | 101½ |
| Puget Sound Pwr. & Lt... | 5½s | 1949 | *k*101 | .... | .... |
| QUEBEC PWR..... | 6s | 1953 | 103½ | 101½ | 104 |
| Queensborough Gas & E... | 5s | 1952 | 100½ | 99½ | 100½ |
| Queensborough Gas & E... | 6s | 1953 | 105 | 104 | 105½ |
| Quincy (Ill.) Gas, Elec. and Heat..... | 5s | 1935 | 94½ | 93 | 94½ |
| RHINE-WESTPHALIA ELECTRIC PWR..... | 7s | 1950 | *k* 96½ | .... | .... |
| Rio de Janeiro Tram., Lt. & Pwr..... | 5s | 1935 | 94 | 93 | 94½ |
| Robbins & Myers..... | 7s | 1952 | 56 | 56 | 68½ |
| Rochester Gas & Elec.... | 5½s | 1948 | 105½ | 104½ | 106 |
| Rochester Gas & Elec.... | 7s | 1946 | *k*111½ | .... | .... |
| Rochester Ry. & Lt..... | 5s | 1954 | 101½ | 100½ | 101½ |
| Rockford Elec..... | 5s | 1939 | 100½ | 99½ | 100½ |
| Rome Wire..... | 6s | 1940 | 99 | 98 | 100½ |
| ST. MAURICE PWR... | 6½s | 1953 | 108½ | 108 | 109½ |
| St. Paul Gas Lt..... | 5s | 1944 | 100½ | .... | .... |
| St. Paul Gas Lt..... | 5½s | 1954 | 101½ | 101 | 102½ |
| St. Joseph Ry., Lt., H.&P. | 5s | 1937 | 94½ | 91½ | 97 |
| Salt River Valley Wtr.... | 6s | 1938 | *k*100 | .... | .... |
| Salmon River Pwr..... | 5s | 1952 | 101½ | 100½ | 101½ |
| San Antonio Gas & Elec.. | 5s | 1949 | 97½ | 96 | 97½ |
| San Antonio Pub. Serv... | 6s | 1952 | 105½ | 101½ | 105½ |
| San Diego Cons. G.&E.... | 5s | 1939 | *k*101½ | .... | .... |
| San Diego Cons.G.&E.... | 6s | 1939 | 102½ | 101 | 102½ |
| San Joaquin Lt. & Pwr.. | 5s | 1945 | 100½ | 98½ | 100 |
| San Joaquin Lt. & Pwr.. | 6s | 1950 | 104½ | 103 | 104½ |
| San Joaquin Lt. & Pwr.. | 6s | 1952 | 105 | 99½ | 104 |
| San Joaquin Lt. & Pwr.. | 6s | 1954 | 103½ | 100½ | 103½ |
| Sauda Falls..... | 5s | 1955 | 95½ | 93 | 96 |
| Savannah Elec. & Pwr.... | 7½s | 1941 | *k*106½ | .... | .... |
| Saxon Pub. Wks. (Germany)..... | 7s | 1945 | *k* 95 | .... | .... |
| Scranton Electric..... | 5s | 1937 | 102 | 101½ | 102½ |
| Seattle Elec..... | 5s | 1930 | 100½ | 100½ | 101½ |
| Seattle Elec..... | 5s | 1929 | 99½ | 99½ | 100½ |
| Seattle Elec..... | 5s | 1939 | 93½ | 92½ | 94½ |
| Seattle Ltg..... | 5s | 1949 | 93½ | 90½ | 94 |
| Servel Corp..... | 6s | 1931 | *k*102½ | 99½ | 104½ |
| Shawinigan Wtr. & Pwr.. | 5s | 1934 | *k*101½ | .... | .... |
| Shawinigan Wtr. & Pwr.. | 5½s | 1950 | 104½ | 103½ | 105 |
| Shawinigan Wtr. & Pwr.. | 6s | 1950 | *k*104½ | .... | .... |
| Sheboygan Elec..... | 5s | 1946 | 97½ | 94½ | 98 |
| Siemens & Halske..... | 7s | 1928 | *k* 98½ | 96 | 100 |
| Siemens & Halske..... | 7s | 1935 | *k* 96½ | 93 | 98 |
| Sierra & San Fran. Pwr... | 5s | 1949 | *k* 80 | .... | .... |
| Sierra & San Fran. Pwr.... | 6s | 1949 | *k* 91½ | 90 | 92½ |
| Sioux City Gas & Elec.... | 6s | 1947 | 103½ | 101½ | 104½ |
| Sioux City Gas & Elec.... | 6s | 1949 | 103½ | 102 | 103½ |
| So. Caro. Gas & Elec..... | 6s | 1942 | 90 | 78 | 97 |
| So. Caro. Gas & Elec..... | 6s | 1932 | 80 | 70 | 82 |
| Southeast Pwr. & Lt..... | 6s | 2025 | *k* 94½ | 89 | 94½ |
| So. Cal. Edison..... | 5s | 1939 | *k*102 | .... | .... |
| So. Cal. Edison..... | 5s | 1944 | *k*101 | 96½ | 101 |
| So. Cal. Edison..... | 5½s | 1944 | 104½ | 103 | 105 |
| So. Cal. Edison..... | 6s | 1943 | 104½ | 102 | 104½ |
| So. Cal. Edison..... | 6s | 1944 | *k*105 | .... | .... |
| So. Cities Utilities..... | 8s | 1931 | *m* 99 | 99 | 102 |
| Southern Colo. Power.... | 6s | 1947 | *k*100 | .... | .... |
| So. Ind. Gas & Elec..... | 6s | 1947 | *k* 99½ | .... | .... |
| Southern Pwr..... | 5s | 1930 | 100½ | 100 | 101 |
| So. Public Utilities..... | 5s | 1943 | 100½ | 100 | 101½ |
| So. Sierras Pwr..... | 6s | 1936 | *k*105 | .... | .... |
| So. Wisconsin Pwr..... | 5s | 1938 | 92½ | 91 | 93 |
| Southwestern Gas & E.... | 5s | 1932 | 97½ | 97 | 98½ |
| Southwestern Gas & E.... | 6s | 1957 | 97½ | 97½ | 99½ |
| Southwestern Lt. & Pwr.. | 6s | 1937 | 98 | 98 | 99½ |
| Southwestern Power..... | 6s | 1944 | 96½ | 96½ | 98 |
| Southwestern Pwr. & Lt.. | 5s | 1943 | *k* 97 | .... | .... |
| Southwestern Pwr. & Lt.. | 6s | 2022 | 95½ | 94 | 96½ |
| Southwestern Pub. Serv.. | 6s | 1945 | 96 | 94 | 96 |
| Southwestern Utilities.... | 8s | 1936 | 110½ | 92½ | 96 |
| Springfield Lt., Ht. & Pwr. | 5s | 1933 | 98½ | 99 | 100½ |
| Standard Elec. of Cal.... | 5s | 1939 | 100 | 99½ | 101 |
| Standard Gas & Elec..... | 6s | 1935 | *k* 98 | .... | .... |
| Staten Island Edison..... | 6½s | 1953 | 106½ | 106 | 107½ |
| Superior Water, Lt. & Pwr. | 4s | 1931 | 95 | 94½ | 95½ |
| Syracuse Ltg..... | 5s | 1951 | 101½ | 100 | 101½ |
| Syracuse Ltg..... | 5½s | 1954 | 104½ | 103½ | 104½ |
| TAMPA ELEC..... | 5s | 1933 | *k* 99 | .... | .... |
| Tenn. Elec. Pwr..... | 6s | 1947 | *k*105½ | .... | .... |
| Tenn. Pwr..... | 5s | 1962 | 98 | 96 | 97 |
| Tex. Pwr. & Lt..... | 5s | 1937 | 99½ | 98½ | 100 |
| Tex. Pwr. & Lt..... | 6s | 2022 | 99 | 95½ | 97 |
| Tide Water Pwr..... | 6s | 1942 | 102½ | 100 | 101½ |
| Tide Water Pwr..... | 7s | 1937 | 104 | 100 | 107 |
| Toho Elec. Pwr. (Japan) . | 7s | 1955 | *k* 92½ | .... | .... |
| Tokyo Elec. (Japan)..... | 6s | 1928 | *k* 98½ | .... | .... |
| Toledo Edison..... | 5s | 1947 | 100½ | 100 | 100½ |
| Toledo Edison..... | 7s | 1941 | *k*108½ | .... | .... |
| Toledo Gas, Elec. & Htg. | 5s | 1935 | 100½ | 98 | 100½ |
| Toledo Tr., L.&P. (notes) | 5½s | 1930 | 98½ | 98 | 99½ |
| Topeka Edison..... | 5s | 1930 | 99 | 99 | 100 |
| Topeka Ry. & Lt..... | 5s | 1933 | 94½ | 94½ | 96½ |
| Trenton Gas & Elec..... | 5s | 1949 | 102½ | 100½ | 102½ |
| Tri-City Ry. & Lt..... | 5s | 1930 | *k* 98½ | .... | .... |
| Twin State Gas & Elec... | 5s | 1953 | 96½ | 95 | 96½ |
| Twin State Gas & Elec... | 5½s | 1945 | 100½ | 98 | 100½ |
| Tyrol Hydro-Elec. Pwr.. | 7½s | 1955 | *k* 95½ | .... | .... |
| UJIGAWA ELEC PWR. | 7s | 1945 | 92½ | 92 | 94 |
| Union Elec. Lt. & Pwr.... | 5s | 1932 | 102 | 100½ | 102½ |
| Union Elec. Lt. & Pwr.... | 5s | 1933 | 101½ | 100½ | 101½ |
| Union Elec. Lt. & Pwr.... | 5s | 1954 | 100½ | 99½ | 101 |
| Union Elec. Lt. & Pwr.... | 5½s | 1954 | *k*101 | .... | .... |
| United Elec. of N.J..... | 4s | 1949 | 89½ | 87½ | 89 |
| United Elec. Lt. & Pwr... | 4½s | 1929 | 99 | 98 | 99½ |
| United Lt. & Pwr. (notes) | 5½s | 1928 | 99½ | 99 | 100½ |
| United Lt. & Pwr..... | 5½s | 1959 | 96½ | 96 | 97½ |
| United Lt. & Pwr..... | 6½s | 1974 | 96½ | 95½ | 98½ |
| United Lt. & Rys..... | 5s | 1932 | *k* 96½ | .... | .... |
| United Lt. & Rys..... | 6s | 1926 | 99½ | 100 | 101½ |
| United Lt. & Rys..... | 6s | 1952 | 100½ | 99 | 101½ |
| United Lt. & Rys..... | 6s | 1973 | 90½ | 89½ | 92 |
| United Pwr. & Lt..... | 6s | 1944 | 102 | 102 | 103½ |
| United Water, G. & E.... | 5s | 1941 | 95½ | 94 | 95 |
| Utah Lt. & Trac..... | 5s | 1944 | *k* 95½ | .... | .... |
| Utah Pwr. & Lt..... | 5s | 1944 | *k* 98½ | .... | .... |
| Utah Pwr. & Lt..... | 6s | 1944 | 103 | 102½ | 104½ |
| Utah Pwr. & Lt..... | 6s | 2022 | 95½ | 88½ | 95 |
| Utica Elec. Lt. & Pwr.... | 5s | 1950 | 102½ | 100½ | 102½ |
| Utica Gas & Elec..... | 5s | 1957 | 101½ | 100½ | 102½ |
| Utica Gas & Elec..... | 5½s | 1949 | 104½ | 103½ | 104½ |
| VERMONT HYDRO - ELEC..... | 6s | 1929 | 100 | 100 | 101 |
| Vicksburg Lt. & Trac.... | 5s | 1932 | 95½ | 93½ | 95½ |
| Virginian Pwr..... | 5s | 1942 | 100½ | 88 | 99 |
| Virginian Pwr..... | 6½s | 1954 | *m*103½ | 103 | 104½ |
| Virginia Ry. & Pwr..... | 5s | 1943 | *k* 99½ | .... | .... |
| Virginia-Western Pwr.... | 6s | 1953 | 105 | 101½ | 106½ |
| WAGNER EL. MFG..... | 7s | .... | *b*100½ | 100 | 101½ |
| Washington Coast Util... | 6s | 1941 | 102½ | 102½ | 103½ |
| Washington Ry. & Elec... | 4s | 1951 | *m* 82½ | .... | .... |
| Washington Ry. & Elec... | 6s | 1933 | *m*103 | .... | .... |
| Washington Wtr. Pwr.... | 5s | 1939 | 102½ | 101½ | 102½ |
| West Penn Pwr..... | 5s | 1963 | 102½ | 99½ | 102½ |
| West Penn Pwr..... | 5s | 1946 | 103 | 99½ | 103 |
| West Penn Pwr..... | 5½s | 1953 | *k*105½ | .... | .... |
| West Penn Pwr..... | 7s | 1946 | *k*105½ | .... | .... |
| W. Va. Lt., Ht. & Pwr... | 6s | 1929 | 101½ | 101 | 102½ |
| West Virginia Utilities.... | 6s | 1935 | 99 | 95½ | 99 |
| W. Va. Water & Elec..... | 6½s | 1942 | *m*103½ | 102½ | 104 |
| Westchester Ltg..... | 5s | 1950 | 102½ | 102 | 103½ |
| Western Elec..... | 5s | 1944 | 102½ | 100½ | 103½ |
| Western N. Y. Utilities... | 5s | 1946 | 98 | 96½ | 98 |
| Western Pwr..... | 6½s | 1954 | 101½ | 100 | 102 |
| Western Pow r of C na'a | 5s | 1949 | 94½ | 94 | 95½ |
| Western Pub. Service.... | 6s | 1950 | 98½ | 98 | 99½ |
| West States Gas & Elec.. | 5s | 1941 | 100 | 98½ | 100½ |
| West States G.&E. (notes) | 6s | 1937 | 94½ | 94½ | 96 |
| West States Gas & Elec.. | 6s | 1947 | *k*101½ | .... | .... |
| West United Gas & El.... | 5s | 1950 | 102 | 101½ | 102½ |
| Westphalia Un. Elec. Pwr | 6½s | 1950 | *k* 86 | 84 | 87½ |
| Westinghouse El. & Mfg. | 7s | 1931 | *k*105½ | .... | .... |
| Wheeling Elec..... | 5s | 1941 | 99 | 99 | 100 |
| Wichita R. R. & Lt..... | 5s | 1932 | 84½ | 83 | 88 |
| Winnipeg Elec..... | 6s | 1954 | *k* 96½ | .... | .... |
| Wisconsin Elec. Pwr..... | 5s | 1954 | 99½ | 98½ | 100 |
| Wisconsin Gas & Elec.... | 5s | 1952 | *k*100½ | .... | .... |
| Wis.-Minn. Lt. & Pwr.... | 5s | 1944 | *k* 97½ | .... | .... |
| Wisconsin Pwr., Lt. & Ht | 5s | 1946 | 93½ | 92 | 94½ |
| Wisconsin Pub. Service.. | 6s | 1952 | 101½ | 101 | 102½ |
| Wis. Ry., Lt. & Pwr..... | 5s | 1933 | 95½ | 94½ | 96½ |
| Wis. River Pwr..... | 5s | 1941 | 94 | 92½ | 94 |
| Wolverine Pwr..... | 7s | 1943 | 102½ | 100 | 101½ |
| YADKIN RIVER PR.. | 5s | 1941 | *k*100 | .... | .... |
| Yarmouth Lt. & Pwr..... | 5s | 1937 | 84 | 83 | 87 |
| Yarmouth Lt. & Pwr..... | 8s | 1951 | 102 | 99 | 102 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, June 1. *l*Bid, low, high, Wednesday, June 2. *m*Latest quotations available. *n*1925.

# Manufacturing and Markets

## Non-Uniformity of Business Practices

### Study by Electric Power Club Shows Unnecessary Diversity of Commercial Methods in the Industry—Data Point to Self-Evident Need for Further Investigations

LACK of uniformity of simple business practices among manufacturers in the electrical industry was clearly shown in the report of N. A. Wolcott, chairman of the business policies committee of the Electric Power Club, at the annual meeting held last week at Hot Springs, Va. On the matter of cash discounts there was a wide variation in practices, yet in contradistinction to the electrical manufacturer's attitude is the similarity of the cash discount—and a small one at that—which is extended by the suppliers of basic raw materials.

The activities of the business policies committee were the result of seven resolutions previously passed by the club which requested the committee to undertake the collection from its membership of permissible information on trade practices pertaining to past transactions. Of the 79 members of the Power Club, 66, or 84 per cent, contributed to the gathering of these data. This actually represents a considerably larger percentage of the manufactured products of the membership since the larger manufacturers are included in those replying.

#### TERMS OF PAYMENT

One of the questions asked the manufacturers by the committee was:

What is the length of your terms of payment to the various customer classifications for the goods falling in the various sections?

The terms of payment followed in the past by the membership indicate a very uniform term of 30 days from date of invoice to all customer classifications, since 84 per cent of the replies received designate that period. About 11 per cent indicate special terms of 50 per cent at the time of shipment, 40 per cent in 30 days, and 10 per cent in 60 days on special large contracts for heavy apparatus such as large motors, mining and industrial locomotives, large transformers, high-voltage switching equipment and comprehensive central-station installations. One company grants terms of 60 per cent at time of shipment, 20 per cent in 30 days, and 20 per cent in 60 days, and another extends terms of 50 per cent at time of shipment and 50 per cent in 30 days. The latter was a substantially large company.

#### TRADE ACCEPTANCES

With regard to trade acceptances, 72 per cent of the members do not encourage their use and themselves do not give them, but they do accept them in preference to promissory notes in some instances. Nearly 23 per cent of the companies replying have no trade-acceptance terms and positively will not use trade acceptances. The percentage of those voting "yes" as shown by sections is: small motors, 30 per cent; large motors, 40 per cent; storage batteries, 50 per cent; transformers, 55 per cent, and power switchboards, 60 per cent. It is apparent that the industry as a whole prefers the regular open-account terms, even though the majority in the transformer and power switchboard sections favor the use of trade acceptances.

The range of trade-acceptance terms is 30, 45, 60 and 90 days, the prevailing terms being 30 and 60 days. Four sections predominate as having definite trade-acceptance terms, namely, small motors, large motors, industrial control and transformers. An interesting exception is that of three manufacturers of large motors who give 5 per cent for 30-day trade acceptances to their resale trade provided they are mailed within ten days from the invoice date. The majority make no distinction as to the classes of trade to which trade-acceptance settlements are offered. Those who accept trade acceptances rather under protest do so only from financially responsible customers who are proverbially slow and from those who ask for promissory-note settlements.

#### CASH DISCOUNTS

The answers to the question as to what cash discounts are allowed disclosed some very interesting and widely divergent practices. About 45 per cent of the replies indicate no cash discount terms. The other 55 per cent allowing cash discounts are divided as follows: 31 per cent offer 1 per cent discount for ten days, 43 per cent offer 2 per cent for ten days, and 26 per cent offer 5 per cent for ten days. The sections that reported a majority using cash discounts were small motors, large motors, electric welding and industrial control. The storage-battery section is equally divided on the cash discount and the no cash discount policies. All of the other sections show majorities following the no cash discount policy, with the oil circuit breaker and instrument sections unanimous on this policy.

Three large manufacturers of both small and large motors extend special discounts of 5 per cent for 30 days to their resale trade and to contract dealers. One manufacturer of small motors extends terms of 5 per cent for 60 days but allows no other cash discount; another extends terms of 60 days net less 10 per cent for 30 days and an additional discount of 2 per cent for ten days. In addition to these special cases, six of the small-motor manufacturers and three of the large-motor manufacturers allow a cash discount of 5 per cent for 30 days and two allow 5 per cent for 60 days. Two small-motor manufacturers allow 5 per cent for 60 days, and one allows central-station companies 10 per cent for ten days, jobbers 5 per cent for 30 days, and small users 1 per cent for ten days.

It probably will be generally conceded that such liberality, both in discounts and in discount periods under the guise of cash discounts, is a misnomer, for in reality it amounts to a trade discount. It is easily observed from the context of the questionnaires that the policies of a considerable number of companies reflect more uniform terms, and their leadership should be helpful in bringing about conditions that are more nearly comparable with those of other seasoned industries. However, the small and large motor sections have no monopoly in the extension of extreme terms, for one manufacturer in the industrial control section extends terms of 10 per cent for 30 lays and an additional 2 per cent for ten days. As to the tolerance allowed beyond the number of days designated as the cash discount period, 50 per cent make no allowance whatever, while the other 50 per cent allow from one to six days, depending upon the distance the remittance has to travel. Of those who indicated their experiences with cash discounts, 85 per cent report them as "satisfactory."

#### CONSIGNED STOCKS

The consignment of stocks seems to be practically confined to the small-motor, large-motor and transformer sections, as the following table indicates:

| Sections | Number of Replies Received | Have Consigned Stocks in Per Cent | No Consigned Stocks in Per Cent |
|---|---|---|---|
| Small motor | 33 | 70 | 30 |
| Large motor | 33 | 73 | 27 |
| Transformer | 14 | 80 | 20 |
| All others | 12 | 50 | 50 |
| Average in per cent | .. | 68 | 32 |

It is apparent that the average of all of the members reporting on this subject shows a ratio of two to one in the consigning of their products, as compared with those who do not consign, whereas the ratio of the small-motor, large-motor and transformer sections taken together is three to one. The small and large motor sections consign chiefly to branch offices, while the transformer section members usually carry their consigned stocks with jobbers. These data indicate that consigned stocks may be considered as bordering on "standard practice" in the above-mentioned sections.

Of the members 94 per cent do not allow credit balance or standing credit in lieu of consigned stocks. There are only four companies that are following this practice at this time—the majority being in the industrial control section.

Of those who carry consigned stocks, 53 per cent have a fixed policy regarding their consigned stock turnover rate, but some report they find it difficult to maintain a fixed policy owing to competition and general conditions in the trade. The small-motor, large-motor and transformer sections, which are the only ones that do any appreciable amount of stock consigning, have turnover rates as follows: 20 per cent require two turnovers per year, 28 per cent require three turnovers per year, 48 per cent require four turnovers per year, 4 per cent require five turnovers per year. Totaling the other sections, they are about evenly divided between two and three turnovers per year. One large manufacturer reports that he has some stocks that actually turn over more than six times per year, but this is not the required turnover rate. It is evident from the above that four turnovers per year is the prevailing practice. In connection with consigned stocks items of freight, etc., are paid as follows:

| Items | By the Manufacturer in Per Cent | By the Consignee in Per Cent |
|---|---|---|
| Freight | 22 | 78 |
| Cartage to warehouse | 21 | 79 |
| Warehousing | 19 | 81 |
| Insurance | 39 | 61 |
| Average | 25 | 75 |

About 98 per cent of the answers indicate that there is no difference in the handling of freight, cartage, warehousing and insurance except where free delivery points are maintained, in which cases freight is usually prepaid by the manufacturer to those points.

### Guarantee Terms

The percentages of replies received concerning length of guarantee terms covering material and workmanship is as follows: No time, 7; two months, 1; three months, 2; six months, 14; twelve months, 76.

One member stated that the Electric Power Club's guarantee is not right for small motors, but did not volunteer an opinion as to what change he favors.

The length of guarantee of twelve months as given in the "Recommended Business Policies" of the Electric Power Club is the policy of 76 per cent of those who answered this question. Not a single member championed the policy of longer guarantees than those now in use. One member giving guarantees of twelve months thinks six months is sufficiently long.

In determining conditions that led to the establishment of free delivery points more than 48 per cent of those answering said that they maintained free delivery points, and 74 per cent of this number gave competition as their reason for establishing them; 9 per cent blamed the competition of the larger manufacturers, while 17 per cent gave miscellaneous reasons as follows: (a) Condition of freight terminal points, warehousing and competition; (b) established for convenience on standard apparatus sold in large quantities at logical distributing centers; (c) equalization of retail prices; (d) purchasers' wishes; (e) to conform to company's policy in distributing another line of manufactured goods; (f) diversity of location of electrical manufacturing plants.

About 56 per cent of those reporting make no freight allowance whatever. The remaining 44 per cent practice a wide range of freight adjustments which lack all semblance of uniformity. For example, 16 per cent of those who allow freight adjustments have no definite policy but pay when they must meet competition, 8 per cent prepay the freight to destination and absorb the freight, 52 per cent allow freight to free delivery points, 13 per cent allow freight on and east of the Mississippi River and 11 per cent allow freight east of the Mississippi River with definite allowances of from 60 cents to $2 per 100 lb. to points west of the Mississippi River. Nearly 90 per cent of those who allow freight use the designation "f.o.b. point of origin with freight allowed to destination." This phraseology, of course, relieves the manufacturer of all legal responsibility as soon as the bill of lading is signed for his goods, although it is customary for the manufacturer to assist the consignee by furnishing the necessary data to recover lost shipments or transportation damages.

### Cash Discounts in Other Industries

The length of terms and cash discounts extended by suppliers of basic materials is radically different from those extended by the electrical manufacturers. These discounts show some variation but they are small. Uniform terms of 30 days are allowed, and cash discounts vary from nothing to 2 per cent with all cash discount periods covering ten days. The discounts allowed are tabulated as shown in the accompanying table.

CASH DISCOUNTS ALLOWED THE ELECTRICAL INDUSTRY BY SUPPLIERS OF BASIC RAW MATERIALS

| Raw Materials | Number of Replies Received | Per Cent Allowing No Cash Discount | ½ Per Cent Ten Days in Per Cent | 1 Per Cent Ten Days in Per Cent | 2 Per Cent Ten Days in Per Cent |
|---|---|---|---|---|---|
| Copper wire | 42 | 10 | 71 | 17 | 2 |
| Copper rod | 35 | 11 | 26 | 54 | 9 |
| Copper strip | 35 | 11 | 26 | 54 | 9 |
| Iron castings | 37 | 34 | 0 | 33 | 33 |
| Steel castings | 26 | 38 | 12 | 31 | 19 |
| Sheet steel | 38 | 0 | 8 | 18 | 74 |
| Insulators | 26 | 27 | 0 | 42 | 31 |
| Insulating materials | 36 | 8 | 0 | 48 | 44 |

### Service Charges

About 82 per cent of the manufacturers have a definite service charge policy based on a percentage of the billing price. The amount of this percentage varies from 10 per cent to 25 per cent of the billing price for standard finished goods, while on goods that are special the service charge runs as high as 50 per cent. About 78 per cent have a service policy on repair parts which is based upon a percentage of the billing price varying from 10 per cent to 25 per cent.

About 61 per cent of the manufacturers give definite guarantees as against 39 per cent who give approximate guarantees. The larger manufacturers are divided on this question of guarantees, and there seem to be good arguments and strong adherents on each side. Practically all of those who expressed themselves on the subject of guarantee tolerances stated that they were following Electric Power Club standards.

### Penalty and Bonus Contract

Not a single member favored a penalty and bonus clause in contracts. The various answers expressed a wide range of degrees of denunciation from the mildest to the most violent. The percentage of total factory capacity utilized during 1925 fluctuates through wide limits, not only among the sections but also within the sections themselves. A tabulation of the replies is herewith presented. The average of 70 per cent of factory capacity utilized during 1925 may be considered as a rough approximation of the activities of the members of the club.

PERCENTAGE OF FACTORY CAPACITY USED IN 1925

| Section | Number of Replies | Average of Factory Capacity in Per Cent |
|---|---|---|
| Small motors | 17 | 66 |
| Large motors | 17 | 68 |
| Electric welding | 1 | 40 |
| Mining and industrial locomotives | 2 | 90 |
| Electric tools | 2 | 80 |
| Industrial control | 7 | 94 |
| Transformers | 7 | 61 |
| Oil circuit breakers | 1 | 50 |
| Power switchboards | 1 | 60 |
| High-voltage switching equipment | 4 | 67 |
| Storage battery | 1 | 70 |
| Instruments | 1 | 100 |
| Instrument transformers | 1 | 15 |
| Total and average | 62 | 70 |

### New Problems Mainly Commercial

Many of the requests received from members asking for suggestions concerning additional activities which the club might pursue resolve themselves into the gathering of statistical data and mainly deal with commercial problems. Some of the suggestions are: (1) Arrange for gathering more statistical data for the industry; (2) engage in statistical activities in connection with sales, production and cost; (3) further the standardization of motor ratings to reduce the number of ratings which must be built; (4) collect and compile business statistics; (5) help educate the commercial end not to believe the worst of a competitor; (6) pay more attention to the commercial and less to technical matters; (7) establish machinery for collecting accurate price data on past transactions, thus avoiding misunderstandings owing to incorrect sales reports and volunteered information from other sources; (8) do everything possible to solve commercial problems; (9) reclassify customers and standardize sales contracts and discounts; (10) standardize commercial practices.

The committee feels that these data gathered from its membership are an eloquent appeal for the still greater work to be done and a bold challenge to those who may feel that the Electric Power Club has fulfilled its mission of technical standardization and holds no promise of assistance in the solution of other practical vital problems by which every member of the organization is constantly confronted.

# New Industry Association Outlined

## Analysis of Conditions by Electrical Manufacturers' Council—Basis of a New Structure Founded on the Sections—Wide Scope for Useful Service

ANALYZING conditions in the Associated Manufacturers of Electrical Supplies and the Electric Power Club, the committees of the Electrical Manufacturers' Council which have been working on the reorganization plans have accumulated a large amount of data. These data were gathered for the purpose of facilitating the study of the question of dues, the company memberships in the reorganized association, etc. The membership statistics are as follows:

| | A.M.E.S | E.P.C. | N.E.M.A. |
|---|---|---|---|
| Total member companies | ... | ... | 290 |
| Companies in both A.M. E.S. and E.P.C. | ... | ... | 17 |
| Net number of companies | ... | ... | 273 |
| Executive representatives | 223 | 112 | *335 |
| Associate representatives | 197 | 100 | *297 |
| Total executive and associate representatives | 420 | 212 | *632 |
| Total sections | 25 | 9 | 34 |
| Company section affiliations | 329 | 112 | 441 |

* Without deduction for duplication in the names of those who are representatives in both the A.M.E.S. and the E.P.C.

Thus the National Electrical Manufacturers' Association, if formed, will contain within its own broad structure more than thirty distinct recognized branches of the industry, each having separate, clearly defined interests but all meeting together in their concern for the well being of the industry as a whole. It is proposed to weld the more active working elements of the present organizations into one cohesive unit, assuring necessary co-ordination between these elements as a matter of routine within a single body, instead of through the complicated machinery of interrelated, separate organizations.

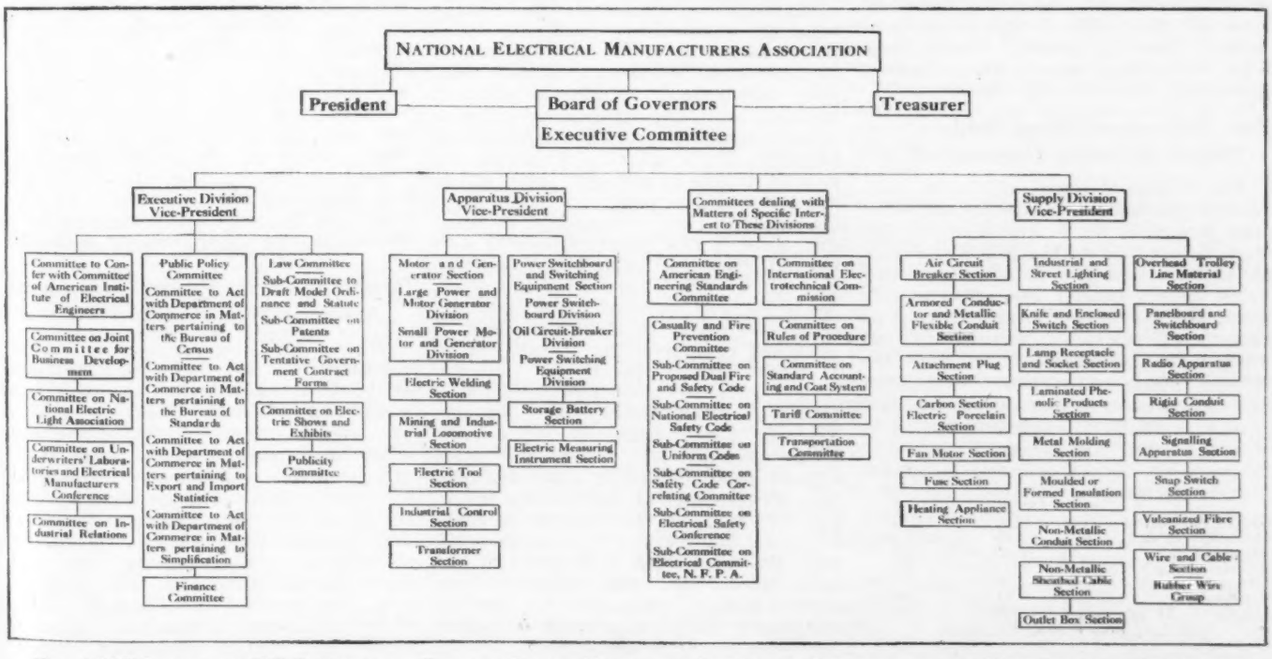
The new simplified structure, like the old one, has as its foundation the sections. It is in and through these that the first appeal to the members lies. They are the important basis on which the structure itself is to be built. Members of the A.M.E.S. are familiar with the number and extent of the sections of their organization. Electric Power Club members are similarly well informed regarding the sections of that organization. The accompanying diagram pictures the two groups of sections listed under the respective supply and apparatus divisions. The supply division includes, as will be noted, the present A.M.E.S. sections. The apparatus division includes the present E.P.C. sections. Within a number of the A.M.E.S. and E.P.C. sections there are subdivisions with groups or committees which are indicated only in part on the diagram.

### Policy and Co-ordinating Committees

The committees listed on the diagram are the present committees of the Electrical Manufacturers' Council. In the diagram they have been divided arbitrarily into two classes. The committees which deal particularly with matters of policy are listed under the new executive division. The committees which in membership or activities, or both, are more directly tributary to or co-ordinate more directly the work of the apparatus and supply divisions of the industry are segregated to make that relation clear. This may be illustrated by references to conspicuous committees the character of whose work rests, in one case—to cite the public policy committee—on matters of policy affecting the industry broadly, or the casualty and fire prevention committee, the work of which touches closely the individual interests of many sections.

The grouping of committees into these two classes is, as indicated, purely an arbitrary one. Some of the committees whose functions might be regarded as almost wholly executive or of a nature affecting policy would necessarily be seriously concerned at times with matters involving a single section or a small number of sections.

The organization of the new association means the development of an executive division whose possibilities for new work which will be helpful to the sections are very large. It may be expected that the officers and board of governors of the new association will devote their earnest thought to the upbuilding of this division in ways that will enhance the standing and achievements of the industry as a whole. The new association, with its vast scope for useful service to its members and to the industry at large, will no doubt be followed by a quickening of activities. With its large opportunities and with its acceptance by other branches of the electrical industry as an active force, the new association will stand on a wide threshold, looking toward the future with confidence and the expectation of rendering a valuable service unobtainable in any other way.


National Electrical Manufacturers Association
President
Board of Governors
Executive Committee
Treasurer
Executive Division Vice-President
Committee to Confer with Committee of American Institute of Electrical Engineers
Committee on Joint Committee for Business Development
Committee on National Electric Light Association
Committee on Underwriters' Laboratories and Electrical Manufacturers Conference
Committee on Industrial Relations
Public Policy Committee
Committee to Act with Department of Commerce in Matters pertaining to the Bureau of Census
Committee to Act with Department of Commerce in Matters pertaining to the Bureau of Standards
Committee to Act with Department of Commerce in Matters pertaining to Export and Import Statistics
Committee to Act with Department of Commerce in Matters pertaining to Simplification
Finance Committee
Law Committee
Sub-Committee to Draft Model Ordinance and Statute
Sub-Committee on Patents
Sub-Committee on Tentative Government Contract Forms
Committee on Electric Shows and Exhibits
Publicity Committee
Apparatus Division Vice-President
Motor and Generator Section
Large Power and Motor Generator Division
Small Power Motor and Generator Division
Electric Welding Section
Mining and Industrial Locomotive Section
Electric Tool Section
Industrial Control Section
Transformer Section
Power Switchboard and Switching Equipment Section
Power Switchboard Division
Oil Circuit-Breaker Division
Power Switching Equipment Division
Storage Battery Section
Electric Measuring Instrument Section
Committees dealing with Matters of Specific Interest to These Divisions
Committee on American Engineering Standards Committee
Casualty and Fire Prevention Committee
Sub-Committee on Proposed Dual Fire and Safety Code
Sub-Committee on National Electrical Safety Code
Sub-Committee on Uniform Codes
Sub-Committee on Safety Code Correlating Committee
Sub-Committee on Electrical Safety Conference
Sub-Committee on Electrical Committee, N. F. P. A.
Committee on International Electrotechnical Commission
Committee on Rules of Procedure
Committee on Standard Accounting and Cost System
Tariff Committee
Transportation Committee
Supply Division Vice-President
Air Circuit Breaker Section
Armored Conductor and Metallic Flexible Conduit Section
Attachment Plug Section
Carbon Section Electric Porcelain Section
Fan Motor Section
Fuse Section
Heating Appliance Section
Industrial and Street Lighting Section
Knife and Enclosed Switch Section
Lamp Receptacle and Socket Section
Laminated Phenolic Products Section
Metal Molding Section
Moulded or Formed Insulation Section
Non-Metallic Conduit Section
Non-Metallic Sheathed Cable Section
Outlet Box Section
Overhead Trolley Line Material Section
Panelboard and Switchboard Section
Radio Apparatus Section
Rigid Conduit Section
Signalling Apparatus Section
Snap Switch Section
Vulcanized Fibre Section
Wire and Cable Section
Rubber Wire Group

THE A.M.E.S. AND THE E.P.C. GROUPS OF SECTIONS LISTED UNDER THE RESPECTIVE DIVISIONS OF THE NEW INDUSTRY ASSOCIATION

## Electric Credit Association Elects New Officers

At the twenty-eighth national conference of the National Electrical Credit Association the following officers were elected: President, H. E. Wilkins, Belden Manufacturing Company, Chicago; vice-president, F. P. Bell, Westinghouse Electric & Manufacturing Company, Philadelphia; secretary-treasurer, Frederic P. Vose, and assistant secretary-treasurer, Walter S. Vose. The association states that the total number of unsatisfactory accounts reported during 1925 were 18,677 and the total amount involved, $2,257,708, as compared with 18,648 and $2,342,984 respectively during the previous year.

# Business Conditions

SALES in the industry show a tendency to decline, but many negotiations are reported under way for projects advanced both by central-station companies and industrial plants. Manufacturers are expecting a slight recession in sales, as compared with the previous months of the year, but anticipate an improvement in the late summer or early fall so that total business for the year will probably show a slight increase over the previous year. The demand for general purpose motors, although showing a falling off in spots, is on the whole continuing at a good rate.

In the New England district many negotiations are under way for power equipment, although present business has decreased. Small motor sales continue to show a slight recession with sales to date higher than for the same period last year. Industrial buying is being maintained in the New York district. The demand for small motors is particularly good, and based on present inquiries it is expected that industrial business will be good throughout the month. In the southeast appliance and range sales are very active, and line construction material is selling well. Several large industrial jobs are being figured by contractors in that district but no contracts have been awarded to date. An order for $100,000 worthy of electrical equipment for a large cement plant in Alabama was received by a manufacturer. In the St. Louis territory merchandising business is especially active and switchboard builders report exceptionally good sales. A slight recession is noted in the Middle West, and utility companies are actively engaged in extension work. On the Pacific Coast many inquiries have been received from industrial firms, and orders placed by the government include $10,000 worth of turbine parts as well as other equipment. Motors from 5 to 20 hp. have been in good demand, principally for pumping service.

## Fair Volume of Metal Sold—Prices Virtually Unchanged

The volume of metal sold in the nonferrous market has been very satisfactory and well up to the level of the week before despite the holiday. Prices show little change, copper and lead being almost exactly the same as last week, zinc advancing slightly owing to rumors of restricted production, and prompt tin easing off a bit with increased supplies available. One interest sold a moderate tonnage of copper at 13¾ cents, delivered at usual Eastern points about a week ago, but then advanced its price to the level generally asked by others—13.8-13.825 cents. The higher figure has been that at which most of the business has been done since last week. Most of the copper sold was for June shipment, indicating that consumers are even more negligent now than before in providing for their future requirements. A little interest was exhibited in July, but August and later months were entirely neglected. Foreign demand has been comparatively light.

Although there is little change in quotations, the tone of the lead market is distinctly better today than a week ago. Whereas the tendency was to shade the prevailing figure of 7.65 cents small premiums over these prices have been obtained on some sales. The American Smelting & Refining Company continues its official contract price in New York at 7.65 cents. A moderate improvement in London has affected sentiment on this side and buyers who have been holding off appear to be ready to supply their requirements at least for the month of June. A fair amount of zinc has been sold and the daily rate of sales has been better than in the previous week. The premium of about ⅛ cent over the prices for prompt tin, Straits, has been discontinued owing to the arrival of new supplies as well as more expected shortly.

NEW YORK METAL MARKET PRICES

| | May 26, 1926 Cents per Pound | June 2, 1926 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 13.8 | 13.825 |
| Lead, Am. S. & R. price | 7.65 | 7.65 |
| Antimony | 12.25 | 9¾ |
| Nickel, ingot | 35 | 35 |
| Zinc, spot | 7.225 | 7.30 |
| Tin, Straits | 61 | 59¾ |
| Aluminum, 99 per cent | 28 | 28 |

Base copper price June 2, 1926, 16 cents.

## Range Sales Active in Southeast—Line Material in Demand

Municipalities and central-station companies in the Southeast continue to buy line construction materials in good volume, and satisfactory orders from power companies for transformers, meters and lamps are also reported. Central-station appliance and range sales are particularly good, one large power company having sold 728 ranges in a six weeks' campaign, another company 600 ranges in four weeks and another company 300 ranges in a month's campaign. An appliance manufacturer states that his business this year to date is 50 per cent ahead of the same period last year.

Contractors are still engaged in figuring quite a few large industrial jobs but no contracts have been awarded. The textile field is quiet at this time. An order was received by a manufacturer last week for $100,000 worth of electrical equipment for installation in a large cement plant in Alabama. Orders for small motors continue satisfactory. Steam railways are not particularly active right now, purchases being normal, but there are some rumors afloat regarding the electrification of a section of the Florida trackage of one of the larger carriers. Lighting fixtures are in good demand, with the total sales well ahead of the same period last year. Orders from central-station companies for battery equipment for remote-control switch operation are reported as good.

## Industrial Buying Maintained in New York District

Sales of equipment for industrial purposes are steadily increasing in the New York district. The demand for small motors is particularly good, some manufacturers reporting sales in this line considerably in excess of their expectations, with indications that this condition will continue. Sales of larger motors also are apparently on the increase, and based on present inquiries it is expected that industrial business will be good throughout the month. Control equipment is selling well and several orders for material for use on merchant ships and ferry boats have been placed recently. Central-station companies are buying steadily, and the total volume of this business compares favorably with the corresponding period last year, without any outstanding features. Watthour meters are in active demand, with a number of orders reported from foreign countries.

## Many Inquiries from Industrial Firms on Pacific Coast

Power company orders on the Pacific Coast have included 100,000 ft. of assorted 3½ in. and 4 in. fibre conduit and 25,000 fuse plugs, and several inquiries from such sources cover line material, transformers, motors and switching equipment. Standard stock motors in sizes from 5 to 20 hp., have been in excellent demand, principally for pumping service and for oil and lumber companies. The United States government Bureau of Supplies & Equipment has placed an order for $10,000 worth of turbine parts and other machinery. The carpenters strike in San Francisco shows no signs of an early settlement, and is having an adverse effect on building permits.

A number of inquiries from industrial plants are reported including equipment for a two-million-dollar sulphite paper manufacturing plant, a shag mill unit addition to a paper plant, and a lumber mill addition, costing about $100,000, to replace a burned structure. A 2,000-kw. steam turbine was purchased by an Everett lumber mill and scattering orders for motors for industrial plants were reported. A new pulp and paper plant has placed a small portion of a large order for electrical equipment. The city of Seattle has completed the electrical specifications for its proposed down-town substation to cost approximately $600,000.

## Negotiations for Power Equipment Active in New England

With a declining tendency in buying marking the tone of the New England electrical market during the past few weeks and a decided subsidence in sales of striking interest, there is, on the other hand, good evidence that favorable prospects loom ahead. In the field of plant equipment, particularly, are the signs very encouraging. A prominent manufacturer records increasing interest in turbo-generator units and reports over thirty negotiations under way, and another manufacturer notes many prospective changes by both paper and rubber companies. Small

motor sales continue to show a slight recession in volume as compared with previous weeks. One concern reports sales for the month of May at about thirty per cent over those of last year for the same month, and another records a similar increase for the first quarter with the demand for larger sizes, ranging from 20 hp. to 50 hp., more active than last year.

Central-station supplies are moving slowly, but wire, small control and switch apparatus, pole-line hardware, pipe, and cable are fairly active. Household appliance sales are spotty and have been influenced by several intensive campaigns now under way. A considerable volume of contracts let is noted in the district for the week but little of it covers industrial work. A favorable demand for high grade lighting effects is noted. A prominent jobber recently reported spring contracts received for fixtures and lights for over fifteen installations of the highest type, and another reports active interest in school lighting and hospital lay-outs.

### Slight Recession Noted in Sales in Middle West

Business continues to hold up well in the Middle West with a slight falling off in the volume. Indications are that agricultural buying is quite heavy. Industrial companies for the most part are quietly operating with no unusual activity noted. Building construction continues favorable and a large program is being planned. The various utility companies are busy with new construction, a great deal of underground extension work being in progress. There has been an active demand for meters, current transformers, etc., while one utility company recently purchased a large quantity of special motors. An interesting order for three 833 kva. single phase transformers was placed this week. Jobbers sales are generally good with a particularly active demand for appliances.

### Merchandising Business Active in St. Louis District

Merchandising continues to lead the various classes of electrical business in the St. Louis district. Building and allied industrial activities are keeping up to previous high points reported. Prospects for electrical business in the petroleum fields adjacent to St. Louis have been even better than in the first part of May. Jobbers report a marked improvement in general business, such as line materials, motors and panel boards. A torrid spell has created a large demand for fans. All sizes of wire have been in good demand—25 per cent to 30 per cent better than earlier reports. Switchboard builders say that inquiries seem a little spotty just now, but business, both local and in territory to the southwest, has been exceptionally good. A contract for a large theater switchboard for San Antonio was closed last week.

# Activities of the Trade

### Moloney Electric Company Plans New Factory

The Moloney Electric Company, St. Louis, has preliminary plans under way for the construction of a plant on a 10-acre tract of land on Bircher Street, near Union Avenue, recently acquired in the name of its subsidiary organization, the Moloney Realty Company. This latter will erect the plant and lease it to the electric company. It is estimated to cost close to $1,000,000 and will be equipped for the construction of large transformers suitable for central-station service. The Moloney company, which has disposed of a bond issue of $1,000,000, is controlled by the American Brown Boveri Electric Corporation, New York. T. O. Moloney is president.

### Refrigerator Standards to Be Determined by New Bureau

The Electrical & Gas Refrigeration Trade Extension Bureau has been formed to maintain standards and discourage the use of mechanical refrigeration as a lure for stock selling. James S. O'Boyle, formerly manager in charge of refrigeration of the New York Edison Company, is president of the bureau, with offices at 97 Liberty Street.

The bureau will designate refrigerators which in the opinion of experts cannot render service and will seek to maintain the industry on an ethical and efficient basis. It will have two advisory engineering councils, one representing makers of mechanical refrigerators and the other representing public utilities and universities. The bureau will approve machines only if tested in approved laboratories for three months and in actual service for one year.

### Graybar Electric to Occupy New Building Next Year

The Graybar Electric Company has recently signed a contract leasing the entire fifteenth floor of the proposed largest office building in the world, and the new structure will be known as the Graybar Building, according to an announcement made by Frank A. Ketcham, executive vice-president. The new building will be located adjacent to the Grand Central Terminal, facing Lexington Avenue and situated between 43rd and 44th Streets, New York. The entire New York executive offices and staff of the Graybar company will move to the new quarters, which will be ready for occupancy on May 1, 1927. The new Graybar Building will be 30 stories high and exclusive of below ground-level space available in other New York skyscrapers, it is said that it will have more office room than any other building of its kind in the world.

**The Electric Refrigeration Corporation**, Buhl Building, Detroit, announces that the Kelvinator division shipped twice as many units in April, 1926, as it did in the same month in 1925, and that the total foreign shipment of Kelvinator separate and self-contained units of household electric refrigerators and commercial models for the first four months of 1926 are considerably in excess of the total foreign sales for the entire year of 1925. The company further announces that on May 1 the New York executive offices and display showrooms of the Kelvinator, Nizer and Leonard divisions were consolidated and they now occupy new quarters in the Brentano Building, 1 West Forty-seventh Street. The company has also recently signed a lease for 27,000 sq.ft. of space in a new building being constructed on Queens Boulevard and Rawson Street, Long Island City, and it will be occupied by the Kelvinator and Nizer Divisions as a service station and warehouse for the metropolitan district.

**The Rome Wire Company**, Rome, N. Y., has announced new and lower prices on Romex wire.

**The Dayton Fan & Motor Company**, Dayton, Ohio, manufacturer of electric fans, motors and radio apparatus, has purchased the Recording & Computing Machines Company plant on Miami Chapel Road and will take possession of it early in June. The new location has 400,000 sq.ft. of factory space and 10 acres of ground and will permit the company to more than treble its factory space.

**The Botfield Refractories Company**, Swanson and Clymer Streets, Philadelphia, manufacturer of "Adamant" firebrick and firebrick cement and refractory furnace linings, announces that the Standard Asbestos & Cork Company, 541 South Troost Street, Tulsa, Okla., has been made a distributor for the company.

**The R. H. Beaumont Company**, 319 Arch Street, Philadelphia, specializing exclusively in coal- and ash-handling equipment for boiler and gas houses, announces the opening of a Western branch at 1544 Strauss Building, 310 South Michigan Avenue, Chicago, in charge of H. E. Birch, for many years sales manager at Philadelphia. Preliminary designs and estimates as well as contract work and construction in the Middle West will be handled from this branch.

**The Edison Lamp Works of the General Electric Company** announces that D. J. Finn, who for a number of years has been on the engineering staff of the company at Harrison, N. J., has been transferred to the Atlanta office where he will serve as illuminating engineer for the entire Southeastern district.

**The Graybar Electric Company** has leased a two-story-and-basement building to be constructed at Twelfth and Capitol Streets, Omaha, Neb., for a new storage and distributing plant. It will be 67 ft. x 115 ft. and is estimated to cost about $75,000.

**Landers, Frary & Clark**, New Britain, Conn., manufacturers of electrical appliances, have filed plans for the construction of a proposed six-story plant addition on East Main Street, to cost appoximately $2,000,000.

# New Trade Literature

DEAD-ENDING CLAMPS.—Bulletin No. 101 issued by the Clark Controller Company, Cleveland, describes and illustrates the screw-jack dead-ending clamps for stranded cable. It also contains instructions for installing the screw-jack clamp.

TACHOMETERS.—Bulletin No. 1,700 issued by the Bristol Company, Waterbury, Conn., describes and illustrates the Bristol tachometers for recording and indicating the speed of revolving machinery, including turbines and generators in power plants, blowing engines in blast furnaces, paper machinery, etc. Included in the bulletin are specimen sections of charts showing round charts for recording electric tachometers and for recording pneumatic tachometers and also diagrams showing methods of belt drive.

TRAFFIC SIGNAL SYSTEMS. — The Crouse-Hinds Company, Syracuse, N. Y., has issued bulletin No. 217, covering its electric traffic signals and control apparatus. It contains illustrations showing a number of typical installations and also its various types of lamps and mountings.

STEEL WELDING RODS.—A booklet issued by the Chicago Steel & Wire Company, 103d Street and Torrence Avenue, Chicago, entitled "Effect of Surface Materials on Steel Welding Rods," contains a discussion of the effect on working qualities of metallic and non-metallic surface materials for both gas and metallic arc welding and gives practical suggestions regarding proper surface materials for gas and electric filler rod. A new arrangement of data on gas and electric filler rod showing, by means of tables, the specifications, uses and comparative properties of the various types of rod is included.

CONNECTORS.—Catalog No. 26, issued by the Burndy Engineering Company, 10 East Forty-second Street, New York City, describes and illustrates the Burndy connectors for copper tubing and cables, for high-tension bus equipment, including "T-connectors," clamp type, straight connectors, reducers, terminals, bus hangers, parallel clamps, etc.

CONDUIT SYSTEM.—The Wiremold Company, Hartford, Conn., has issued a new Wiremold wall chart covering the Wiremold conduit system for surface wiring, conduit for extension and branch circuit work and for large installations in factories, department stores, office buildings, etc., with fittings. Suggestions for installations, dimensions, etc., are included.

ELECTRIC TRAVELING CRANES, FOUNDRY EQUIPMENT, ETC. — The Whiting Corporation, Harvey, Ill., is distributing a folder covering the Whiting products, including electric traveling cranes, foundry equipment, railroad shop equipment, etc. Attention is also called to the "Grindle" pulverized-coal equipment for unit and hopper systems for firing steam boilers, malleable melting furnaces, annealing ovens, etc. The company has published a pamphlet describing "Meehanite metal," which is used to replace cast iron or steel for castings.

ELECTRIC MOTORS.—A folder issued by the Master Electric Company, Linden and Master Avenues, Dayton, Ohio, entitled "Master Motors Make Good," describes and illustrates the three types of Master Motors, "RA," "IM" and "PA," for single-phase, direct-current and polyphase service respectively. A sectional illustration showing details of construction of the motors is included.

FIRE PROTECTION FOR ELECTRICAL EQUIPMENT.—"The Carbon Dioxide Fire System for Electrical Equipment" is the title of a bulletin issued by Walter Kidde & Company, 140 Cedar Street, New York City. The "Lux" system for extinguishing fires in electrical equipment is fully described and installations are illustrated. The two methods of application are described, one for rotary apparatus, generators, converters, etc., and the other for transformers and oil switches. Questions requesting the necessary data for furnishing a proposal are included in the bulletin.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in St. John, New Brunswick (No. 20,528), for miners' lamps and parts.

Purchase is desired in Liverpool, England (No. 20,534), of portable electrical nail extractor, and portable electric saw.

An agency is desired in Alexandria, Egypt (No. 20,476), for centrifugal pumps for irrigation purposes.

An agency is desired in Vienna, Austria (No. 20,523), for refrigerating equipment, dental apparatus and equipment.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## *New England States*

HOLYOKE, MASS.—Plans are under way by the Municipal Gas and Electric Department for the construction of a new steam-driven power plant, to cost about $43,000.

READING, MASS.—A contract between the municipality and the Edison Electric Illuminating Company of Boston for supplying electricity to the municipal electric plant has been approved by the voters. The Edison company will build two 5,000-kva., 13,800-volt underground lines, 15 miles long, between Stoneham and Reading.

WORCESTER, MASS.—The City Council is considering the installation of about 123 new lamps on a number of streets.

HARTFORD, CONN.—The Royal Typewriter Company plans to install electric power equipment in connection with proposed extensions to its plant, to cost about $150,000.

HARTFORD, CONN.—Plans have been filed by the Hartford Electric Light Company for the construction of a substation on Maple Avenue, near Adelaide Street.

MERIDEN, CONN.—Plans have been filed by the Board of Trustees of the Connecticut School for Boys for a new power house, to cost about $60,000.

## *Middle Atlantic States*

BUFFALO, N. Y.—Plans are under way by the Buffalo, Niagara & Eastern Power Company for the erection of a transmission line from Hunts Corners, west a distance of 3 miles, to cost about $100,000.

ELMIRA, N. Y.—Plans for the rebuilding of the printing plant of Baker Brothers, Inc., on Upper Lake Street, include a power plant.

JAMESTOWN, N. Y.—Extensions to the police and fire-alarm telegraph system in the East End, to cost about $10,000, is under consideration by the City Council.

MALONE, N. Y.—Work will soon begin by the Malone Light & Power Company on the construction of a new power plant on the Salmon River in Malone, to cost about $500,000.

NEW YORK, N. Y. — The New York Edison Company has taken out a permit for extensions and improvements in its substation at 33-43 Gold Street, to cost about $40,000.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company, C. S. White, Room 344, 466 Lexington Avenue, purchasing agent, until June 10, for one 2500-kw. synchronous converter and for three single phase 920-kva. air blast transformers, etc. Also, for removal of present equipment from substation (Serial Contract No. 10-1926.)

UTICA, N. Y.—Plans are under way by the Utica Gas & Electric Company to secure the abandoned Erie Canal lands from Utica to Little Falls for the proposed high-tension line from here to Little Falls. The company has applied for permission to erect four high-tension lines instead of three asked for originally.

WESTMORELAND, N. Y. — Permission has been granted the Utica (N. Y.) Gas & Electric Company to extend its transmission line to Westmoreland, a distance of about 5½ miles, and install a distribution system to supply electricity under a franchise granted by the Town Board.

ENGLEWOOD, N. J.—The installation of an improved street-lighting system in the business section is under consideration. Street-lighting service is furnished by the Public Service Electric & Gas Company, Newark.

NORTH BERGEN, N. J.—A survey has been authorized by the North Bergen Township committee preliminary to the installation of a large number of new street lamps in the northern end of the township.

SOUTH AMBOY, N. J.—Bids, it is understood, will soon be asked by the Board of Public Works, for equipment for the electrification of the municipal waterworks.

LANSFORD, PA. — The Pennsylvania Power & Light Company, Allentown, which has acquired the properties of the Panther Valley Electric Company, the Lehighton (Pa.) Electric Light & Power Company, and the Palmerton (Pa.) Lighting Company, plans extensions in transmission lines in these districts.

SMETHPORT, PA.—The McKean Refining Company, Kennedy Street, Bradford, plans to install electric power equipment in connection with proposed extensions in its local oil refinery, to cost about $200,000. H. S. Bell, Woolworth Building, New York, is consulting engineer.

YORK, PA.—The Schmidt & Ault Paper Company, Kings Mill Road, plans to install electric power equipment in connection with the rebuilding of its mill, recently damaged by fire, with loss of about $100,000.

BALTIMORE, MD. — The Summers Fertilizer Company plans to install electric power equipment in connection with the rebuilding of its plant at Clinton Street and Fifth Avenue, Canton, recently damaged by fire with loss of about $300,000.

BALTIMORE, MD.—The Griffith & Boyd Company, Fourth Avenue and Clinton Street, Canton, plans to install electric power equipment in connection with the rebuilding of its fertilizer plant, recently destroyed by fire with loss of about $400,000.

CAMBRIDGE, MD. — The Phillips Can Company plans to install electric power equipment in connection with the rebuilding of its plant recently damaged by fire, with a loss of about $200,000.

COVINGTON, VA.—The construction of a hydro-electric plant at the Home for Homeless Boys, to cost about $15,000, is under consideration.

BELLEVUE, D. C.—The Virginia Electric & Power Company, Richmond, Va., plans to build a local substation.

WASHINGTON, D. C. — Bids will be received by the Board of District Commissioners, District Building, until June 14, for electric lighting fixtures for schools.

WASHINGTON, D. C. — Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until June 15, for electrical supplies. (Panama Circular 1736).

## *North Central States*

JACKSON, MICH. — Preparations are being made by the Consumers Power Company for the erection of a new 10,000-volt transmission line from the substation on the Rives-Junction-Stockbridge line to Pleasant Lake. Electricity will be served to a number of resorts on the lake, including Hankard's Grove and Bartlett's Beach.

MARQUETTE, MICH.—Permission has been granted to the Cliffs Power Company to acquire the hydro-electric power properties of the Cleveland Cliffs Iron Company in Alger and Marquette Counties. Plans are under consideration for expansion, including the erection of transmission lines.

INDIANAPOLIS, IND.—Permission has been granted the Interstate Public Service Company, Indianapolis, to acquire the property of the French Lick & West Baden Water, Light, Heat & Power Company. Extensions in transmission lines are contemplated.

KOKOMO, IND.—The Kokomo Steel & Wire Company plans to install electric power equipment in its proposed wire nail mill, to cost about $250,000.

CHICAGO, ILL. — The Commonwealth Edison Company has taken out a permit to erect a substation, at 1052-56 Newport Avenue, to cost about $20,000.

CHICAGO, ILL.—Plans have been filed by the Commonwealth Edison Company for the erection of a substation at 160 North La Salle Street, to cost about $75,000.

NORTH CHICAGO, ILL. — The Biflex Products Company plans to install electric power equipment in its proposed plant addition, to cost about $350,000.

CUDAHY, WIS.—The installation of a street-lighting system on Packard Avenue

from Plankinton to Carpenter Avenue is under consideration by the City Council.

MILWAUKEE, WIS. — Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 22 for furnishing and installing lighting fixtures, etc., in the United States post office, court house and custom house, Milwaukee. For details see Searchlight Section.

WHITEFISH BAY, WIS.—Extension of the ornamental lighting system on several streets, to include about 150 standards and lamps, at a cost of about $30,000, is under consideration by the Village Council. T. F. Buckley is village engineer.

WISCONSIN RAPIDS, WIS.—Plans are under way by the Consolidated Water Power & Paper Company for the construction of a steam-driven generating plant, to supplement the output of its hydro-electric plant.

LONE ROCK, IOWA. — The Central States Electric Company, Cedar Rapids is planning to erect a transmission line from Lone Rock to Wesley, a distance of 32 miles.

SIOUX CITY, IOWA.—Plans are under way by the Sioux City Gas & Electric Company to install a 1,000-kw. house turbine in the Big Sioux power plant at North Riverside, to cost about $80,000.

JASPER, MO.—The Ozark Utilities Company, Pleasant Hill, contemplates extensions in its transmission line for local service.

FARGO, N. D.—The City Commission has approved plans for the installation of a new ornamental lighting system in the business district, to cost about $23,000. R. T. Jacobson is city engineer.

OGALLALA, NEB.—The installation of an ornamental lighting system in the business section is under consideration by the Council.

SALEM, S. D.—Bids will be received by C. E. Hallas, city auditor, until June 7, for furnishing and installing an ornamental lighting system on Main Street and Norton Avenue. J. P. Streff is city engineer.

HARTINGTON, NEB.—The Diesel Engine & Electric Company, Terminal Building, Lincoln, has engaged H. C. Corey, Aberdeen, S. D., and Prof. J. M. Brown, Engineering Department, South Dakota State University, Vermillion, S. D., engineers, to prepare plans for its proposed local electric plant.

## *Southern States*

CARBONTON, N. C. — The Carolina Power & Light Company, Raleigh, plans to erect a transmission line from Sanford for local service. A substation will be installed.

LOCKHART, S. C.—Plans have been prepared by the Lockhart Power Company for a steam-operated electric power plant, to cost about $250,000, to supply power for the Monarch mills and for distribution in Lockhart and other towns.

ATLANTA, GA.—The erection of a substation on Edgewood Avenue is contemplated by the Georgia Railway & Power Company.

DUBLIN, GA.—The Georgia Southern Power Company, which has recently acquired the municipal electric plants in Claxton, Midville, Lyons and Wadleigh, is now carrying on an extensive construction program for the purpose of interconnecting all the cities and towns now served by the company. F. R. Weller, Mills Building, Washington, D. C., is president.

EATONTON, GA.—The Central Georgia Power Company, Macon, has applied for a franchise in Eatonton. Surveys are being made for a transmission line from Monticello.

LYONS, GA.—The City Council has accepted the proposal of the Middle Georgia Power Company to purchase the municipal electric plant. Under the terms of the sale the company will erect a transmission line from its main plant into Lyons and furnish the city a twenty-four hour service.

SAVANNAH, GA.—The Savannah Electric & Power Company is planning to build a substation at the Isle of Hope. The company is now installing a street-lighting system, to cost about $36,000.

CLEARWATER, FLA. — Arrangements are being made for the installation of an ornamental lighting system along the shore of Clearwater Bay, a distance of 4 miles. The City Commissioners have authorized the installation of street lamps on the recently completed section of Fort Harrison Avenue to the city limits of Dunedin. The city officials of Dunedin have voted in favor of installing ornamental lamps to meet the Clearwater line at the city limits.

PALM BEACH, FLA.—Bids will be received by the Town of Palm Beach until June 8 for extensions to street-lighting system, including ornamental lamps on Palm Beach Avenue.

MOBILE, ALA.—The installation of an ornamental lighting system is under consideration by the City Council.

NORTH BIRMINGHAM, ALA. — Plans for the proposed local lumber mill to be erected by the Estes Lumber Company, 2600 Twenty-eighth Avenue, Birmingham, at a cost of $200,000, include a power plant.

SILOAM SPRING, ARK.—Plans have been approved by the City Council for the installation of an ornamental lighting system in the downtown district. Benjamin Fox is city engineer.

BATON ROUGE, LA.—Bids will soon be asked by the City Council for the installation of a municipal signal system. J. W. Billingsley, Interstate Bank Building, New Orleans, is engineer.

NEW ORLEANS, LA.—Work has started by the New Orleans Public Service, Inc., on extensions to its electric and gas systems, to cost about $6,000,000. The improvements will include the installation of a 30,000-kw., turbo-generator, improvements to the distribution system, construction of a new office building, etc.

SLIDELL, LA.—The Canulette Shipbuilding Company, Inc., plans extensions in the power plant at its shipyard on the Bayou Vincent, including the installation of a 100-hp. Diesel engine, etc.

WELSH, LA.—The Board of Trustees has approved plans for an addition to the municipal power plant, including the installation of new equipment. Ye Planary, Inc., Dallas, Tex., is architect.

BROWNFIELD, TEX.—The Brownfield Power & Light Company plans extensions to its power plant, to cost approximately $30,000.

MINERAL WELLS, TEX.—An investigation and survey of the proposed dam and water storage reservoir on the Brazos River, 6 miles west of here, are to be made by the State Board of Water Engineers, on application of Jay Alexander, Dallas, secretary and treasurer of the Syndicate Power Company, owned by the Insull interests of Chicago. It is proposed to use the water for generating electricity and irrigation purposes.

VERNON, TEX.—Bids will be received by the City Commission until June 8, for one 300-hp. Diesel engine direct-connected to a 300-kva. alternator, 2,300 volts, 60 cycles, three phase, with belt-driven exciter, switchboard, etc. for the municipal electric station.

YOAKUM, TEX.—The City Commission is considering a bond issue to establish a municipal electric power plant and waterworks station.

## *Pacific and Mountain States*

ABERDEEN, WASH.—A special election will be held on June 29, to vote on the proposal to issue $2,000,000 in bonds for a municipal hydro-electric power plant on the Wynooche River with transmission system.

ELMA, WASH.—Plans for the proposed local terra cotta works to be erected by the P. & H. Terra Cotta Company, c/o E. S. Avey, Montesano, to cost about $250,000, include a power plant.

SNOHOMISH, WASH. — The Great Northern Railway Company, St. Paul, Minn., has applied for permission to construct a hydro-electric plant on Deception Creek, Snohomish County, with initial capacity of 11,500 hp., for use in connection with the electrification of its railway in this district.

BERKELEY, CAL.—The installation of ornamental lamps is contemplated by the City Council. Frank B. Rae is city electrician.

FOWLER, CAL.—The Board of City Trustees plans to install ornamental lamps on Merced Street.

FRESNO, CAL.—Final permits have been granted by the State of California to the San Joaquin Light & Power Company for water rights along the Kings River and tributaries for its extensive water power developments. The proposed development, parts of which have been under way for some time, includes the construction of nine power houses and fourteen dams, which will aggregate a total capacity of 500,000 horsepower.

LOS ANGELES, CAL.—Plans for the proposed packing plant to be erected by the Baldridge Packing Company, Inc., at 1,303 East Vernon Avenue, to cost about $50,000, include a power house and refrigerating plant.

LOS ANGELES, CAL.—Bids will be received by the Board of County Supervisors, Hall of Records, Los Angeles, until June 14, for the installation of ornamental lamps on San Gabriel Boulevard, using metal standards.

LOS ANGELES, CAL.—Bids will soon be asked by the City Council for the installation of ornamental lamps on Temple Street using pressed steel standards; Kenisto Avenue, concrete standards; Western Avenue, pressed steel standards; June Street, McCadden Place, Cherokee and Las Palmas Avenues, concrete standards.

OAKLAND, CAL.—Plans are being prepared by the Great Western Power Company, 530 Bush Street, San Francisco, for a local office building to be erected at Seventeeth Street and Broadway, to cost about $300,000. Ashley & Evers, 58 Sutter Street, San Francisco, are architects.

RIVERSIDE, CAL.—The City Council has authorized the installation of ornamental lamps on Terracina Drive, using concrete standards. A. P. Campbell is city engineer.

SALINAS, CAL.—Application has been made by the Pacific Gas & Electric Company, San Francisco, for permission to erect a transmission line from Manteca to Salinas, about 98 miles, to cost about $600,000.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company, 625 Market Street, has applied for permission to use water from Hering Creek, a tributary of the Stanislaus River, Tuolumne County, for a hydro-electric power development, to cost about $100,000.

SAN FRANCISCO, CAL.—The construction of another large hydro-electric plant on the Mokelumne River in Amador and Calaveras Counties to supplement the output of the Electra plant is planned by the Pacific Gas & Electric Company. The project includes a concrete-faced dam 200 ft. high, creating a reservoir of 60,000 acre-ft. capacity. From this dam water will be conveyed by canal and tunnel to Tiger Creek, where it will be dropped 1,200 ft. to a new power house of 47,000 hp. capacity. After passing through the Tiger Creek power house the water will be carried on to the Electra plant. The total cost of this development is estimated at about $10,000,000.

PUEBLO, COL.—Plans are under way by the City Council for the installation of ornamental lamps in the business section, totaling about forty-eight standards. D. P. Gaymon is engineer.

PUEBLO, COL.—Plans are under way by the Southern Colorado Power Company for a steam-operated electric generating plant at South Victoria Avenue and D Street, to cost about $300,000.

RIFLE, COL.—The property of the Rifle Light & Power Company has been acquired by the Public Service Company of Colorado, Denver. The new owners plan to erect a transmission line to connect the local system with its hydro-electric plant at Shoshone, 40 miles distant. The cost is estimated at $65,000.

ALBUQUERQUE, N. M.—Plans are being prepared by the Department of Indian Affairs, Department of Interior, Washington, D. C., for the construction of a power plant at the local Indian School. Reuben Perry is superintendent of the institution.

## *Canada*

WINNIPEG, MAN.—Plans for the consolidation of the six or seven transmission line extensions of the Manitoba Power Commission's service, involving the erection of about 100 miles of new transmission lines, has been approved by W. R. Clubb, Minister of Public Works for Manitoba. The proposal has been submitted to fifteen municipalities, and if ratified, the project will be carried through. It is proposed to link up the southern part of the province into a comprehensive system.

COPPER CLIFF, ONT. — The International Nickel Company, 67 Wall Street, New York, plans to install electric power equipment in connection with proposed extensions and improvements in its local mills, to cost about $1,500,000.

MANICOUAGAN, QUE.—Work on the development of 40,000 hp. on the Ontarde River, on the north shore of the St. Lawrence River in the Province of Quebec has been started by the Ontario Paper Company, Montreal, Que. The project also includes a pulp mill to have a daily capacity of 100 tons.

MONTREAL, QUE.—The City Council has authorized an issue of $71,800 in bonds for lamp standards and cables in connection with new street-lighting systems.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued May 4, 1926)

1,583,384. TRANSFORMER TANK; R. V. Bingay, Pittsburgh, Pa. App. filed Jan. 9, 1922. Adapted to contain a long transformer within relatively small over-all dimensions and at the same time to possess increased mechanical strength and efficiency in cooling; an oil-cooled transformer having the corrugations along the sides of the transformer progressively increasing in size toward the center of the sides, with bands encircling said tank and secured to the outer bends of said corrugations.

1,583,445. SEMI-DRY ELECTROLYTE FOR STORAGE BATTERIES; N. L. Collins, Iowa City, Iowa. App. filed Aug. 17, 1922. In which acid electrolytes are used. A semi-dry or gelatinous electrolyte composed of silicic acid and sulphuric acid, and as little or no sodium is present to attack the plates, disintegration thereof from that cause is eliminated.

1,583,460. ELECTRIC IRON WITH REMOVABLE HEATING ELEMENT; N. Hansson, Chicago, Ill. App. filed May 4, 1925.

1,583,462. SUPPORTING PIN FOR INSULATORS; L. E. Hendee, Milwaukee, Wis. App. filed March 8, 1922. Insulator pin that may be clamped to cross-arms of different sizes.

1,583,474. SWITCH-BOX SUPPORT; E. H. Kruse, Fort Wayne, Ind. App. filed Oct. 12, 1923.

1,583,479. ELECTRIC WIRE CONNECTOR; W. P. Marr, Toronto, Ontario, Canada. App. filed March 3, 1923. A tubular member closed at one end to receive and rigidly hold the wire ends and to provide a tubular insulating inclosure for the aforesaid tube.

1,583,517. BATTERY BOX; E. R. Barany, Brooklyn, N. Y. App. filed May 25, 1922. Adapted to receive a plurality of cells connected in circuit.

1,583,578. POWER SYSTEM; C. T. Crocker, R. Stearns and L. W. Webb, Schenectady, N. Y. App. filed Oct. 18, 1923. System of electric ship propulsion wherein a plurality of electric generators and motors are arranged to be connected with each other in various ways by means of switches and wherein the combination of switches operated is predetermined by a selector mechanism arranged to control the connection between the switches and the means by which they are operated.

1,583,582, 1,583,583. ELECTRIC HAMMER; M. D. Dominguez, New Orleans, La. App. filed April 26, 1924. Electromagnetic.

1,583,593. DISCHARGE TUBE WITH INCLOSED ARC DISCHARGE; G. Holst, E. Oosterhuis and J. Bruijnes, Eindhoven, Netherlands. App. filed Sept. 26, 1922.

1,583,599. ELECTRIC SWITCH; G. W. Lieberum, Bridgeport, Conn. App. filed Feb. 6, 1924. Double-action, rotary-type snap switch.

1,583,601. DELAYED-ACTION ELECTRIC SWITCH; Medford, Ore. App. filed Jan. 21,1926.

1,583,607, 1,583,608. ELECTRIC METER PROTECTING MEANS; G. H. Sauton, New Orleans, La. App. filed Aug. 18, 1922.

1,583,622. AUTOMATIC PHASE-SHIFTING APPARATUS; C. P. Steinmetz, Schenectady, N. Y. App. filed Aug. 27, 1923. For a mechanical rectifier so as to maintain automatically the correct commutating position of the brushes with respect to the commutator with changes in load.

1,583,632. VOLTAGE-REGULATING SYSTEM; W. Weiler, Niederschonhausen, Germany. App. filed April 27, 1923. An arrangement for regulating the voltage of an alternating-current synchronous generator, which, owing to the character of the load connected to the generator and the normal magnetic characteristic of the generator, cannot be regulated by the ordinary method of field control, as in a case where a long transmission line is energized; means for changing the magnetic characteristic of the generator by varymg the saturation of certain parts of the magnetic circuits.

1,583,648. STORAGE BATTERY; R. C. Benner, Bayside, N. Y. App. filed Sept. 2, 1922. The combination with electrodes and an electrolyte of a container therefor, vapor-arresting means carried by said container above said electrolyte, and absorbent means carried by said container above said vapor-arresting means. For portable units.

1,583,649. ACTIVE MATERIAL SUPPORT FOR STORAGE CELLS; R. C. Benner, Bayside, N. Y. App. filed Sept. 8, 1922.

1,583,697. ELECTRICAL CONNECTOR; A. E. Latham, Brooklyn, N. Y. App. filed Nov. 10, 1921. Comprises a conducting socket portion, a sleeve of insulating material surrounding the same and having an interior bore threaded at one end, a plug portion of conducting material, a sleeve of insulating material therearound, said last-mentioned sleeve on the face adjacent the socket portion having a recess into which the end of the first-mentioned sleeve extends, said plug having a projecting head to extend into the bore of the socket portion and threaded along a portion of said head to engage with the threads in the bore of the socket, whereby the socket member and the plug member are tightly engaged.

1,583,760. CLOCK-CONTROLED SWITCH; G. H. Roney, Washington, D. C. App. filed Dec. 21, 1925.

1,583,766. CABLE JOINT; R. W. Atkinson, Perth Amboy, N. J. App. filed Nov. 26, 1924. In which electrostatic strain is distributed over extended surfaces and the surfaces themselves are so perfectly insulated as to remove and make remote the danger of breakdown.

(Issued May 11, 1926)

1,583,792. BATTERY-CHARGING DEVICE; R. W. Niles, Ypsilanti, Mich. App. filed Sept. 22, 1922. Inclosed vibrating-type rectifier.

1,583,804. SELF-STARTING MOTOR; J. T. Sibley, New York, N. Y. App. filed Sept. 19, 1923. For use in connection with talking machines and is characterized by the employment of a pair of field magnets between the poles of which the armature poles of a disk rotor are made to swing, each of the magnets being connected to a separate source of electrical supply. Improved means for alternately closing and breaking the circuit leading to the magnets, whereby they are alternately energized to give the rotor a rapid succession of electromagnetic impulses and thereby maintain a uniform rate of rotation.

1,583,809. DYNAMO-ELECTRIC MACHINE; H. M. Stoller, Mountain Lakes, N. J. App. filed April 18, 1924. Inductor type, for use in vacuum-tube circuits. For supplying current which is free from objectionable disturbances over a given frequency range.

1,583,859. STORAGE BATTERY; F. L. Sears, Nicholasville, Ky. App. filed April 7, 1924. With visible built-in hydrometer.

1,583,871. VENT PLUG FOR ELECTRIC ACCUMULATORS AND THE LIKE; A. L. Davis, London, England. App. filed Feb. 13, 1922.

1,583,884. ATTACHMENT PLUG FOR ELECTRIC HEATING DEVICES; W. Ile, Jackson, Mich. App. filed June 11, 1925.

1,583,906. METHOD OF ELECTRIC WELDING AND APPARATUS THEREFOR; E. J. von Henke, Chicago, Ill. App. filed Nov. 10, 1923. Electric seam welding produced by a succession of closely spaced spotwelds.

1,583,938. DELAYED CUT-OUT FOR PULL SOCKETS; R. D. Smith, Scarsdale, N. Y. App. filed Nov. 3, 1920.

1,583,939. DETENT-TRIPPING MECHANISM FOR SOCKET SWITCHES; R. D. Smith, Scarsdale, N. Y. App. filed Nov. 8, 1920. May be applied to delayed cut-offs for pull sockets.

1,583,948. ELECTRIC SWITCH; G. E. Weissenburger, Keokuk, Ia. App. filed Nov. 20, 1922. Pressure controlled switch with quick-acting contact-making device.

1,583,961. ELECTRIC STEAM GENERATOR; G. H. Crowell, Berlin, N. H. App. filed April 15, 1925. Self-contained and arranged so that the electric heater unit will be immersed in the coldest part of the water.

1,584,059. DEVICE FOR MAINTAINING UNIFORM CONTACT AND PRESSURE BETWEEN A STATIONARY AND REVOLVING BODY FOR ELECTRICAL MACHINES; W. C. Wheeler, Chicago, Ill. App. filed June 27, 1924. Whereby a predetermined and uniform pressure may be maintained between a carbon brush and a commutator.

1,584,063. DASHPOT-CONTROLLED SWITCH; G. O. Wilms, Milwaukee, Wis. App. filed Feb. 20, 1920. A delay device to prevent opening of the circuit upon a momentary or temporary overload and having means for readily adjusting the time factor in the operation of the switch.

1,584,064. SHORT-CIRCUITING DEVICE; E. M. Wright, Springfield, Ohio. App. filed June 26, 1924. For the armature windings of single-phase induction motors, particularly of the type which employes centrifugal balls as the means for operating the devices.

1,584,094. STORAGE BATTERY; N. Harrison, Milford, Conn. App. filed June 19, 1922. Utilizing thinner and stronger plates than heretofore employed in batteries, whereby the full potential capacity of the plates can be effective to store and discharge electrical energy quickly, and to equip the battery with means for rendering the plates effective and durable to perform their intended function.

1,584,106. ELECTRIC HEATING ATTACHMENT FOR HOT-WATER BAGS AND THE LIKE; M. C. Levinson, Long Beach, Cal. App. filed March 24, 1925. Screw stopper for hot-water bags carrying an electrical heating element adapted to be actuated by the temperature of the liquid in the bag when attached thereto.

1,584,143. ELECTRICAL SWITCH; T. Rhodus, Chicago, Ill. App. filed April 30, 1924. Quick-make, contact-wiping switch.

1,584,158. LIQUID CONTROLLER FOR TWO-PHASE AND THREE-PHASE SLIP-RING MOTORS; A. West, Brighton, England. App. filed Feb. 14, 1924. With the movable electrodes arranged to move in a horizontal or substantially horizontal plane.

1,584,248. STORAGE BATTERY AND ELECTRODE THEREFOR; T. Spencer, Indianapolis, Ind. App. filed June 11, 1924. In which active materials of positive and negative polarity are carried in conductive relation on the same support. A compact, high-voltage battery assembly characterized by substantial freedom from short-circuiting and buckling.

1,584,253. ROTOR FOR INDUCTION MOTORS; H. L. Tanner, Brooklyn, N. Y. App. filed June 14, 1921. Squirrel-cage type for use in small induction motors adapted to be supplied with current of relatively high frequency and which require to be started under load.

1,584,281. ELECTRIC HEATER; J. S. Dumas, Montreal, Quebec, Canada. App. filed Aug. 25, 1923. Of the portable type adapted to the dual purpose of heating and cooking.

1,584,318. SOLDERING IRON; F. Morgan, Chicago, Ill. App. filed Jan. 22, 1923.

1,584,356. LIMIT-CONTROL SYSTEM; E. F. Chandler, Brooklyn, N. Y. App. filed March 18, 1924. Methods and apparatus for overload control of devices in which a predetermined amount of travel is required. It more particularly refers to methods of and apparatus for remote control of valves and other devices in which a predetermined to-and-from travel is required, such as, for instance, a bulkhead door, a railway switch or signal, a gun turret, a lock gate, etc.

1,584,366, 1,584,367. ELECTRIC SWITCH; F. P. Gates, West Hartford, Conn. App. filed Jan. 16, 1924, and Feb. 7, 1924. Snap switch.

1,584,383. HIGH-SPEED ELECTRIC MACHINE; C. L. Leblanc, Paris, France. App. filed March 21, 1922. Including in combination a flexible shaft, a metallic mass suspended from said flexible shaft and so constructed and arranged as to constitute both the rotor of a single-wheel rotary machine, said rotors being continuous and in alignment, and a single casing inclosing said rotors.

1,584,411. ELECTRICALLY HEATED PRESSING AND LAUNDRY IRON; T. Wallace, Wabash, Ind. App. filed Jan. 7, 1921. Having means for automatically breaking the circuit between the terminals, when the irons are not in use, together with means for automatically completing the circuit when pressure is applied to the handle of the iron during use.

1,584,423. CIGAR LIGHTER; J. W. Bate, Racine, Wis. App. filed May 11, 1925.

1,584,502. DYNAMO-ELECTRIC MACHINE; V. G. Apple, Dayton, Ohio. App. filed March 20, 1920. Method of producing an element of a dynamo-electric machine which consists in coating the laminae thereof with a heat-hardening insulating cement and temporarily securing them together by application of pressure; applying the windings thereto, impregnating them with a similar cement, and then hardening the cement by application of heat.

1,584,511. ELECTRIC HEATING APPARATUS; R. H. Cunningham, New York, N. Y. App. filed April 22, 1924. With thermostatically operated temperature control.

1,584,524. GROUND CONNECTION; R. C. Fisher, Rochester, N. Y. App. filed Jan. 25, 1923. The combination with a binding-post projecting through, but insulated from, a conductive body and provided with screw-threaded fastening means of a grounding device in the form of a metal cup, centrally perforated to receive said fastening means, the free edge of the cup being pressed into engagement with the surface of said conductive body around the binding post.

# Business Facts for Electrical Men

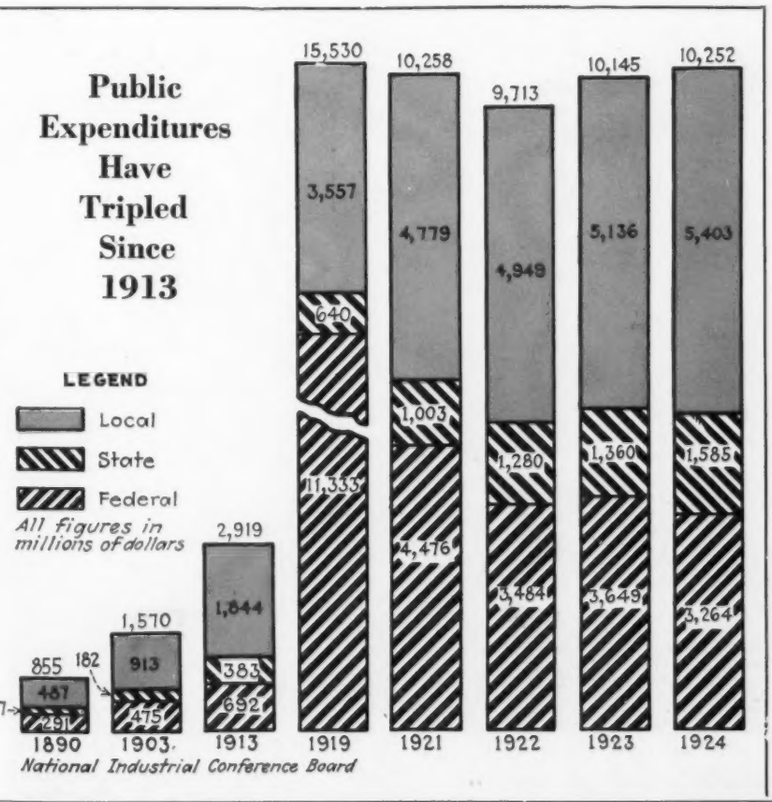
Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## Higher Taxes—Lower Electric Bills

THE American people have ever been the personification of growth and development. Starting as tiny settlements on the Atlantic Coast, this group of people have slowly multiplied and pushed westward across the mountains and plains until their domain today is limited only by the waters of the Atlantic and Pacific. The economic environment of the people has also slowly changed and expanded, each stage bringing to them a better and richer mode of living. New standards have been set up both in the home and in the civic life of the nation. The luxuries of yesterday have become the necessities of today —even as Main Street has developed into a thoroughfare of roaring motor traffic.

The attainment of these perfections of home and civic life has cost the people an ever-increasing amount. Especially has this been true as regards the national and civic life of the people. Back in 1890 the public service cost the people $855,000,000. By 1913 this amount had increased almost fourfold, and 1924 saw a total of $10,252,000,000 being spent for the benefits of public service. The value of the dollar has, of course, changed during this period, but even if the 1924 figures are deflated to the purchasing power of the dollar in 1913, expenditures of the federal government in 1924 were still three times as high as in 1913, those of the state governments about two and a half times as high, and those of the local governments somewhat less than twice as high. These increased public expenditures have been borne by the people in two ways—by direct tax and by indirect tax through the higher cost of manufactured products due to the taxes paid by the manufacturing companies. It is an outstanding fact, however, that in the item of electrical energy the public, both in the home and in the field and factory, has been required to pay less and less while at the same time receiving more efficient illumination and more reliable power service.

In the midst of these general economic conditions, therefore, the electric light and power industry stands out in bold relief. Here is an industry which, in spite of continually mounting taxes, higher wages and higher cost of apparatus and material of all kinds, has been able to cut the price of electrical energy to the consumer in the large cities by 9.9 per cent since 1913. Not only have the actual electric bills of the nation been materially reduced during this period, but through increased lamp efficiency the actual amount of illumination per dollar has been increased from 9,903 candle-hours to 16,500 candle-hours, an increase of 67 per cent. Such a public service, attained by a continual struggle against general economic conditions, is one of the greatest accomplishments of the electric light and power industry.




Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

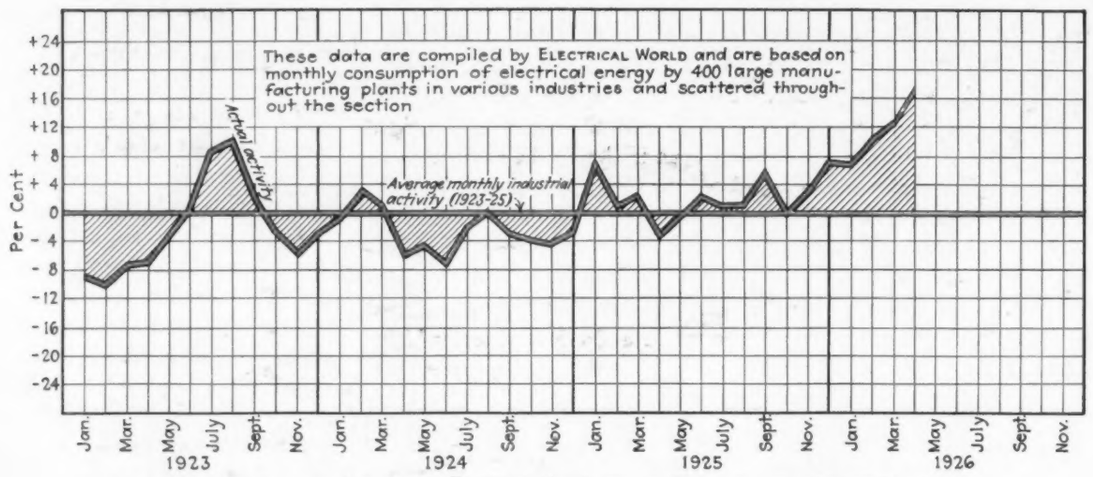
# Western States Report Increased Industrial Activity

THE ELECTRICAL WORLD presents herewith a new service for its readers in the Mountain-Pacific States in the form of a barometer of industrial activity in various industries of that section. This barometer is based upon the energy consumption of about 200 large central-station power customers distributed throughout the section and in various industries. These monthly consumption data for each industry have been adjusted for seasonal variation and compared with the average annual consumption during the 36-month period 1923-1925. The monthly activity in each industry has been weighted in accordance with the importance of that industry to obtain the general industrial activity of the section. A barometer for the country as a whole for the month of April will be found on page 1082 of the May 15 issue of the ELECTRICAL WORLD, and similar barometers will be issued for each section of the nation. These barometers may be obtained as soon as they are available upon application to the ELECTRICAL WORLD.

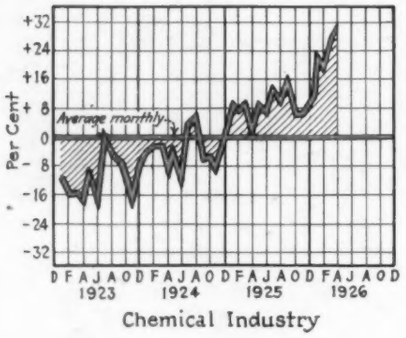
The upward trend in activity which has been witnessed by the industries of the Mountain-Pacific States since last November was continued during April. This is a materially different picture from that presented by the industries of the country as a whole. In their case the industrial activity during April was about 8 per cent below that of March, although considerably above that for April of last year. Not only was industrial activity in the Western States above that of March, but it was materially above the activity reported by the industries of the section in April of last year. Such is the picture of industrial operations outlined by the ELECTRICAL WORLD and based upon the monthly consumption of 200 manufacturing plants scattered throughout the section. Returns received by the ELECTRICAL WORLD indicate that during April general industrial activity in the Western States was 17.3 per cent above the average monthly industrial activity for the past three years, after corrections for seasonal variation have been made, as compared with an activity of 3.7 per cent below the average monthly reported for April of last year. In March general industry in the Western States was operating at 12.5 per cent and in February at 10.2 per cent above the average monthly.

All the six leading industries of the Western States with the exception of the lumber industry reported increased activity during April. All of the primary industries, however, without exception reported April activities above those of April last year.

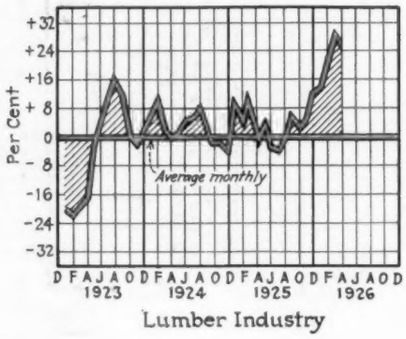
## "Electrical World" Barometer of Industrial Activity in the Western States



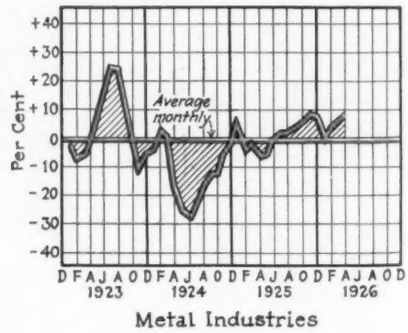

General Industrial Activity in the Mountain-Pacific States



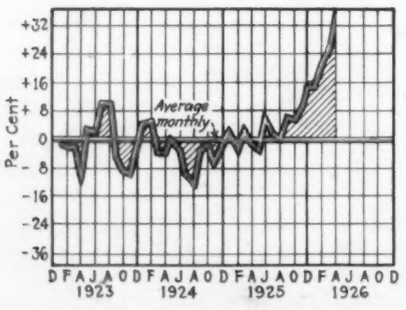

Chemical Industry



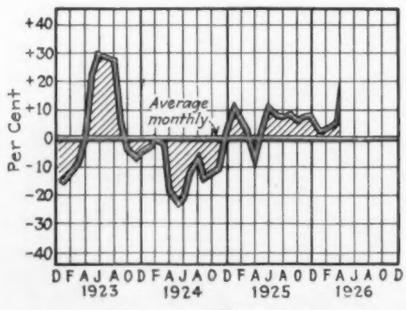

Lumber Industry



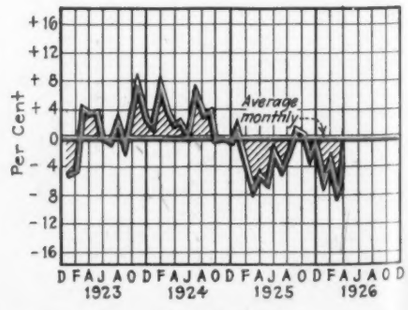

Metal Industries




Paper Industry




Transportation Equipment




Food Industry